



# Project HORIZONTAL Validation Report on polyaromatic hydrocarbons

Validation of a horizontal standard  
for the determination of polyaromatic hydrocarbons in soils, sludges and treated  
biowaste using gas chromatography (GC) and high performance liquid  
chromatography (HPLC) in a European Intercomparison Exercise

E. Sobiecka, H. van der Sloot, T. Win, B. M. Gawlik



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# Project HORIZONTAL Validation Report

## Validation of a horizontal standard for the determination of polyaromatic hydrocarbons (PAH) in soils, sludges and treated biowaste using gas chromatography (GC) and high performance liquid chromatography (HPLC) in a European Intercomparison Exercise

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## **Summary**

Project HORIZONTAL is interdisciplinary aiming at a harmonisation and horizontal standardisation of test procedures, in particular for sludge, soils and biowastes. In the context of this standardization project, a series of draft technical specifications were designed upon an extensive desk study, fine-tuned after expert consultations and finally validated in international intercomparisons exercise.

This report summarises the work performed within the validation study of the draft standard for the determination of polycyclic aromatic hydrocarbons in soils, sludge and treated bio-waste using GC and HPLC. It further explains the underlying statistical concept for the calculation of reproducibility and repeatability from intercomparisons data. In addition all single values, results of the statistical evaluation as well as background information on the validation materials used are described and explained.

## Abbreviations

Throughout this report the following abbreviations are used:

ANOVA	Analysis of variances	GC	Gas Chromatography
CAS	Chemical Abstracts System	HPLC	High Performance Liquid Chromatography
CEN	Comité Européen de Normalisation	MILC	Measure Interlaboratory Comparison
DG	Directorate General	p	Number of labs
ECN	Energy Research Centre for the Netherlands	PAH	Polyaromatic Hydrocarbons
EU	European Union	r	Repeatability limit
IES	Institute for Environment and Sustainability	R	Reproducibility limit
IT	Information Technology	s <sub>r</sub>	Repeatability standard deviation
ISO	International Organization for Standardisation	s <sub>R</sub>	Reproducibility standard deviation
JRC	Joint Research Centre	TC	Technical Committee

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## ***Introduction to the validation project***

Project HORIZONTAL is interdisciplinary aiming at a harmonisation and horizontal standardisation of test procedures, in particular for sludges, soils and biowastes. It was created as in response to the European Commission Mandate M 330 given to CEN, asking for the

development and validation of those standards in support of forthcoming EU Directives, such as:

- The revision of the Sewage Sludge Directive 86/278/EEC.
- The Directive on the biological treatment of biodegradable waste.
- The initiative on a legal framework for soil monitoring in Europe.

This mandate explicitly considers standards for the entire analytical procedure (i.e., sampling, pre-treatment and analytical measurement methods for inorganic, organic, hygiene and biological parameters). These are grouped into classes according to their physical/chemical

properties, which in turn determine the methods needed to quantify the potential impact on human and animal health, plant uptake, soil function and groundwater quality. As the materials generally feature a mixture of different types of contaminants, it is important to provide an integrated answer covering evaluation of all relevant pollutants.

In order to fulfil the requirements of the aforementioned mandate, the European Commissions Joint Research Centre (JRC) and its Directorate-General for Environment (DG ENV) together with the Technical Committees of the European Standardisation Committee (CEN TCs) concerned designed a pre-normative research initiative called Project HORIZONTAL and presented it to the Commission and the Environmental Authorities in the Member States.

After an extensive literature research and careful evaluation of the feasibility of a given horizontal standard, the standards were drafted and finally validated in an European laboratory intercomparison.

The underlying statistical concept, information about the materials used, details about the participants, measurement results obtained as well as the derived performance characteristics obtained for the determination of polyaromatic hydrocarbons (PAH) are described hereafter.

## 1.1 Statistical concept underlying the validation

According to the requirements of the work package concerning data handling & interpretation of the project HORIZONTAL-ORG the respective validation intercomparisons have to be evaluated according to the principles laid down in ISO standard 5725-2:1994. In particular repeatability and reproducibility of the draft standard methods have to be determined. The determination of trueness would require the availability of independent reference values for the materials investigated. This, however, is not possible and was not requested in the frame of this work. In the following, the approach chosen is explained.

### 1.1.1 Introduction to the statistical model

The statistical model used in ISO 5725 for estimation of accuracy of a measurement method assumes that every test result is the sum of three components:

$$y = m + B + e$$

*y*: test result

*m*: general mean

*B*: laboratory component of bias under repeatability conditions

*e*: random error occurring in every measurement under repeatability conditions

In the workprogram the quantification of term *e* is explicitly asked for (i.e. repeatability and reproducibility). The repeatability variance is measured directly as the variance of the error term *e*, but the reproducibility depends on the sum of the repeatability variance and the between-laboratory variance:

$$\sigma_r = \sqrt{\text{var}(e)}$$

$$\sigma_R = \sqrt{\sigma_L^2 + \sigma_r^2} \quad \text{with} \quad \sigma_L = \sqrt{\text{var}(B)}$$

However, soil, biowaste and sludge are multi-phase materials, i.e. they contain two or more distinct types of particles which are fundamentally different in their properties and composition. As a consequence, this introduces an important source of variation for the intercomparison exercise which needs to be considered, i.e. the inherent heterogeneity of the materials.

Thus, a contribution of variation between samples *H* is introduced to the general statistical model:

$$y = m + B + e + H$$

Using ANOVA techniques the different variances are calculated and separated for the evaluation.

## 1.1.2 Requirements for precision experiment

### Layout of the experiment

A suite of 10 to 12 different materials (soil, sludge and biowaste) has been made available for the intercomparison exercise. For each parameter investigated, at least 10 laboratories should be nominated to participate. The same laboratories should be used for different parameters as far as possible. Due to the complexity of analysis and the respective workload to the laboratories, it was decided to propose three materials for the validation of the PAH draft standard.

Each laboratory received two bottles of each material and was requested to perform 4 independent analyses per material<sup>1</sup> (2 per bottle) using the respective draft standard methods. The 4 analysis per material should be carried out under repeatability conditions (i.e. same operator<sup>2</sup>, same equipment, within a short period of time). As far as possible, also the different materials should be measured under repeatability conditions; however, changes of e.g. operator or equipment are permitted, but must be reported. Likewise, different materials can be analyzed on different days if necessary.

Equipment used in the experiment needed to be checked prior to the experiment according to the requirements of the draft standard. The results of these checks have to be documented. Similarly, date and time of each measurement had to be recorded for verification of repeatability conditions.

An appropriate timeframe for the entire exercise has been set and was to be respected.

### Recruitment of the laboratories

Each sub-workpackage leader of HORIZONTAL was asked to select the laboratories using the information from section 5.2 of ISO 5725-2:1994 and provide the signed questionnaires (see also Annex 1). The workpackage leaders were responsible for providing the laboratories with the draft standard method and explaining the context of this exercise.

### Preparation and use of the materials

Materials used for the exercise were prepared according to the general requirements for reference materials as laid down in ISO Guide 34. Materials were accompanied by instructions for use.

### Reporting of results

Online submissions of results using an internet-based IT platform as well as XLS-Spreadsheets were used. In case of online data submission, the participating laboratories received a unique and confidential login and password in due time, enabling them to

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<sup>1</sup> Independent analysis means analysis of independent test portions, applying the entire analytical scheme to this test portion, from e.g. extraction to quantification. For instance it does not mean replicate injections of aliquots into a GC-MS instrument.

<sup>2</sup> Operator in this context may also consist of a fixed team of persons, e.g. one person performing extraction, one clean-up, one quantification.

enter their data in a structured form. For authentication purposes a signed printout had to be submitted by mail.

The online data submission included a detailed questionnaire for additional information on the measurements.

### **1.1.3 Statistical analysis**

Statistical analysis of data followed the requirements of ISO 5725-2:1994 and ISO 5725-5:1998. Appropriate tests for the homogeneity of variance, detection of outliers and normal distribution were applied. Statistical evaluation was done using an Excel Macro, developed, tested and successfully applied in other occasion by ECN. Evaluation was executed jointly by JRC and ECN.

## **1.2 Validation exercise for PAH**

### **1.2.1 Isomers to be measured**

The following PAHBs congeners were selected for the validation exercise: Naphthalene (CAS No. 91-20-3), Acenaphthene (CAS No.83-32-9), Acenaphthylene (CAS No.208-96-8), Fluorene (CAS No.86-73-7), Anthracene (CAS No.120-12-7), Phenanthrene (CAS No. 85-01-8), Fluoranthene (CAS No.206-44-0), Pyrene (CAS No.129-00-0), Benz(a)anthracene (CAS No.56-55-3), Chrysene (CAS.No.218-01-9), Benzo(b)fluoranthene (CAS No. 205-99-2), Benzo(k)fluoranthene (CAS No.207-08-9), Benzo(a)pyrene (CAS No.50-32-8), Indeno(1,2,3-cd)pyrene (CAS No.193-39-5), Dibenz(ah)anthracene (CAS No.53-70-3), Benzo(ghi)perylene (CAS No.191-24-2);

### **1.2.2 Samples dispatched for the validation of PAH**

After a preliminary rough screening, the following materials were used for the validation round of PAH:

- Compost 1                      A pollutant loaded compost material from Vienna
- Sewage Sludge 1              A mixed sewage sludge from Essen
- Soil 3                              A sludge amended soil from Barcelona

A more detailed description of background concentrations can be found in Annex 2 to this report. The samples were dispatched simultaneously to all participants using a private courier service.

### **1.2.3 Draft standards to be followed**

The draft standards to be followed could be downloaded following this link, which is situated on the website of the Project HORIZONTAL:

[http://www.ecn.nl/docs/society/horizontal/PAH\\_standard\\_for\\_validation.pdf](http://www.ecn.nl/docs/society/horizontal/PAH_standard_for_validation.pdf)

#### **1.2.4 Analytical programm**

Of each of the three materials 2 bottles had to be analysed and each bottle had to analysed independently twice. As mentioned above analysis were to be done under repeatability conditions. Results were to be reported referring to DRY MATTER content. The choice, how to apply d.m. correction was free for each participant.

#### **1.2.5 Timing and Submission of data**

Dispatch of samples was done on the 18<sup>th</sup> of October 2006. For users of the Online data submission system (MILC), User Registration was possible from 14<sup>th</sup> of November 2006 with opening of the MILC Data Submission on 1<sup>st</sup> of December 2006. The deadline for submission of results has been set for PAH to the 12th of January 2007, but was extended to the end of the same months. After that no further submission was possible.

Alternatively the participants were allowed to submit data electronically as Excel sheet using simply Email.

All data were treated in a confidential way. Any presentation hereafter will refer only to numerical data and it will not be possible to identify the originating laboratory. Lab Codes displayed are NOT related to the order of laboratories hereafter.

In addition to the information provide a Helpdesk was implemented in order to give quick and individual response to the participants during and immediately after the validation study. In case of doubt and suspected transcription errors, further enquires were conducted by JRC.

### 1.2.6 Participants

The following table lists the participating organisations and entities in the validation exercise for the horizontal PAH standard;

- Austria
  - Amt der Salzburger Landesregierung
  - Amt der Steirmärkischen Landesregierung
  - Chemcon Technisches Büro für technische Chemie GmbH
  - Umweltbundesamt
- Belgium
  - VITO
- Czech Republic
  - Soil Science and Conservation Research Institute (SSCRI)
- Finland
  - Consulting Engineers Paavo Ristola Ltd.
- France
  - BRGM-Metrology Monitoring Analysis Department
  - CTC Environnement
  - INERIS
  - PREFECTURE DE POLICE, Laboratoire Central
  - SGS Multilab Laboratoire de l'Essonne
- Germany
  - Bundesanstalt fuer Materialforschung und -pruefung (BAM)
  - UFZ Centre for Environmental Research
- Norway
  - Norwegian Institute for Water Research
- Sweden
  - ALCONTROL AB
- The Netherlands
  - ALCONTROL BV
  - Analytico Milieu B. V.

### **1.3 Summary results and derived performance characteristics**

The result of the various statistical evaluation including outlier tests, calculation of repeatability and reproducibility standard deviation for the congeners of interest can be found in Annex 3 of this report. In addition, all data submitted by the participants as well as those considered for the calculation of the performance characteristics are listed in Annex 3 to this report.

Based on these calculations the following results were obtained in the validation round upon statistical evaluation according to ISO 5725-2. The average values, the repeatability standard deviation ( $s_r$ ) and the reproducibility standard deviation ( $s_R$ ) were obtained (Table 1).

The repeatability is determined as an interval around a measurement result (i.e. "repeatability limit"). This interval corresponds to the maximum difference that can be expected (with a 95% statistical confidence) between one test result and another, both test results being obtained under the following conditions: The tests are performed in accordance with all the requirements of the present standard by the same laboratory using its own facilities and testing laboratory samples obtained from the same primary field sample and prepared under identical procedures. The repeatability limit was calculated using the relationship:  $r_{\text{test}} = f \cdot \sqrt{2} \cdot s_{r,\text{test}}$  with the critical range factor  $f = 2$ .

The reproducibility, like repeatability is also determined as an interval around a measurement result (i.e. "reproducibility limit"). This interval corresponds to the maximum difference that can be expected (with a 95% statistical confidence) between one test result and another test result obtained by another laboratory, both test results being obtained under the following conditions: The tests are performed in accordance with all the requirements of the present standard by two different laboratories using their own facilities and testing laboratory samples obtained from the same primary field sample and prepared under identical procedures. The reproducibility limit was calculated using the relationship:  $R = f \cdot \sqrt{2} \cdot s_R$  with the critical range factor  $f = 2$ .

**Table 1 - Results of the interlaboratory comparison studies of the determination of polyaromatic hydrocarbons (PAH) by gas chromatography and high-performance liquid chromatography in treated biowaste, sludge and soil. All concentrations are expressed in ug/kg dm.**

<i>Matrix</i>	<i>Parameter</i>	<i>Mean</i>	<i>sr</i>	<i>sR</i>	<i>r</i>	<i>R</i>	<i>p</i>	<i>Outliers</i>	<i>Used No of data</i>	<i>No of data reported below detection</i>	<i>Total no of data</i>
Sludge 1	Acenaphthene	87.2	14.9%	64%	36.3	157	12	2	44	4	56
Compost 1		5.5	9.6%	37%	1.49	5.67	5	2	17	16	41
Soil 3		10.9	11.3%	81%	3.46	24.7	6	1	18	28	50
Sludge 1	Acenaphthylene	29.6	34.7%	68%	28.7	56.7	7	2	26	8	42
Compost 1		5.5	9.6%	37%	1.49	5.67	5	2	17	13	38
Soil 3		9.3	15.1%	114%	3.92	29.8	4	0	14	24	38
Sludge 1	Anthracene	227.7	9.1%	44%	57.9	284	18	0	67	0	67
Compost 1		31.8	13.6%	39%	12.1	35	15	1	56	0	59
Soil 3		2.1	16.5%	65%	0.99	3.89	6	1	20	19	43
Sludge 1	Benz(a)anthracene	977.1	14.5%	30%	396	832	16	0	60	1	61
Compost 1		369.3	15.9%	36%	164	369	15	0	60	0	60
Soil 3		2.8	19.5%	69%	1.51	5.36	7	1	24	23	51
Sludge 1	Benzo(a)pyrene	820.0	7.8%	37%	180	851	16	1	58	0	62
Compost 1		381.1	14.2%	22%	151	233	14	1	53	0	56
Soil 3		2.5	23.1%	52%	1.59	3.55	7	0	26	20	46



<i>Matrix</i>	<i>Parameter</i>	<i>Mean</i>	<i>sr</i>	<i>sR</i>	<i>r</i>	<i>R</i>	<i>p</i>	<i>Outliers</i>	<i>Used No of data</i>	<i>No of data reported below detection</i>	<i>Total no of data</i>
Sludge 1	Benzo(b)fluoranthene	1273.7	8.8%	36%	314	1274	15	1	57	0	61
Compost 1		543.5	12.0%	30%	183	457	14	0	55	0	55
Soil 3		3.8	13.6%	50%	1.46	5.34	7	1	25	20	49
Sludge 1	Benzo(ghi)perylene	694.5	7.6%	31%	148	612	15	2	54	0	62
Compost 1		313.6	11.5%	50%	101	441	15	1	56	0	59
Soil 3		2.2		46			3		12	38	50
Sludge 1	Benzo(k)fluoranthene	590.2	8.8%	27%	146	438	16	0	61	0	61
Compost 1		236.1	14.1%	19%	93.4	125	14	1	56	0	59
Soil 3		1.0	30.6%	31%	0.87	0.87	6	2	18	19	45
Sludge 1	Chrysene	1077.0	6.3%	30%	190	914	14	2	53	0	61
Compost 1		424.6	11.2%	37%	133	441	13	0	52	0	52
Soil 3		3.0	20.8%	62%	1.74	5.17	7	0	23	25	48
Sludge 1	Dibenzo(ah)anthracene	193.5	7.6%	41%	41.3	224	14	2	53	0	61
Compost 1		74.3	14.2%	38%	29.6	79	14	0	43	1	44
Soil 3		2.1		85			1		4	47	51
Sludge 1	Fluoranthene	2397.4	5.7%	17%	380	1169	16	1	60	0	64
Compost 1		535.5	10.5%	29%	158	434	14	0	42	0	42

<i>Matrix</i>	<i>Parameter</i>	<i>Mean</i>	<i>sr</i>	<i>sR</i>	<i>r</i>	<i>R</i>	<i>p</i>	<i>Outliers</i>	<i>Used No of data</i>	<i>No of data reported below detection</i>	<i>Total no of data</i>
Soil 3		4.4	14.4%	45%	1.78	5.64	8	1	30	16	50
Sludge 1	Fluorene	178.7	6.3%	28%	31.4	141	16	1	59	0	63
Compost 1		16.8	26.5%	100%	12.5	47	10	1	26	9	39
Soil 3		1.8	8.3%	39%	0.42	1.95	4	2	15	24	47
Sludge 1	Indeno(1,2,3-cd)pyrene	768.0	9.6%	36%	207	777	16	0	61	2	63
Compost 1		303.8	8.9%	29%	75.8	250	14	0	42	1	43
Soil 3		2.4		44			4		16	34	50
Sludge 1	Naphthalene	75.6	10.1%	36%	21.4	75.5	12	3	42	0	54
Compost 1		7.9	5.5%	26%	1.21	5.69	6	3	15	10	37
Soil 3		7.5	7.2%	111%	1.51	23.3	4	1	12	24	40
Sludge 1	Phenantrene	1200.2	5.0%	30%	169	1000	16	2	58	0	66
Compost 1		106.9	10.2%	34%	30.5	101	16	0	60	0	60
Soil 3		7.1	8.0%	48%	1.59	9.54	8	1	27	18	49
Sludge 1	Pyrene	1579.0	5.7%	30%	252	1322	16	1	58	0	62
Compost 1		448.3	12.8%	30%	161	377	16	0	60	0	60
Soil 3		7.1	10.6%	30%	2.1	6	9	0	30	18	48

<i>Matrix</i>	<i>Parameter</i>	<i>Mean</i>	<i>sr</i>	<i>sR</i>	<i>r</i>	<i>R</i>	<i>p</i>	<i>Outliers</i>	<i>Used No of data</i>	<i>No of data reported below detection</i>	<i>Total no of data</i>
Sludge 1	TOTAL PAH	12312	6.35%	29%	2191	10073	15	1	59		
Compost 1	TOTAL PAH	3318.3	21.47%	31%	1994	2860	16	0	61		
Soil 3	TOTAL PAH	44.5	23.20%	51%	28.9	63	10	1	35		

Abbreviations: sr Repeatability standard deviation; SR Reproducibility standard deviation; r Repeatability limit (comparing two measurements); R Reproducibility limit (comparing two measurements); p Number of labs; \*/\* determination not possible.



## **1.4 Annexes**

Annex 1: Model questionnaire to be filled by the participating laboratories

Annex 3: Report on the validation materials used

Annex 2: Statistical calculations

Annex 3: Data submitted



## **Annex 1:**

**Model questionnaire to be filled by the participating laboratories**









## **Annex 2:**

### **Report on the validation materials used**



## **Abstract**

This report gives an overview on the available analytical information on the following raw materials to be used for the production of validation materials of the so-called Project HORIZONTAL:

- Four sludge materials from Düsseldorf, Germany,
- An agricultural soil material from Reading, United Kingdom;
- A compost material from Vienna, Austria;
- A compost material from Korschenbroich, Germany;
- A sludge-amended, agricultural soil from Pavia Province, Italy;
- A sludge-amended soil from Barcelona, Spain
- A sludge-amended soil from Essen, Germany
- A long-term sludge exposed soil from Hohenheim, Germany

## List of Abbreviations

Throughout this report the following abbreviations are used.

AOX	absorbable organic halogens	LoD	limit of detection
C <sub>org</sub>	organic carbon content	LUA	Landesumweltamt
C <sub>total</sub>	total carbon content	N <sub>total</sub>	total nitrogen content
CAT	cation exchangeable	NH <sub>4</sub> -N	Ammonium nitrogen
CDD	chlorinated dibenzodioxin	NO <sub>3</sub> -N	Nitrate nitrogen
CDF	chlorinated dibenzofuran	NP	nonylphenol
DEHP	di(2-ethylhexyl)phthalate	NRW	North Rhine Westphalia
DM	dry matter	O	octa
EPA	Environment Protection Agency	P	poly
EU	European Union	PAH	polycyclic aromatic hydrocarbon
FM	fresh matter	PCB	polychlorinated biphenyl
Hp	hepta	Pe	penta
Hx	hexa	T	tetra
IES	Institute for Environment and Sustainability	TEQ	toxicity equivalent
IRMM	Institute for Reference Materials and Measurements	UBA	Umweltbundesamt
JRC	Joint Research Centre	WHO	World Health Organization
LAS	linear alkylsulfonates	WWTP	waste water treatment plant

## 1 Introduction

This report gives an overview on the available analytical information on the following raw materials to be used for the production of validation materials of the so-called Project HORIZONTAL:

- Four sludge materials from Düsseldorf, Germany,
- An agricultural soil material from Reading, United Kingdom;
- A compost material from Vienna, Austria;
- A compost material from Korschenbroich, Germany;
- A sludge-amended, agricultural soil from Pavia Province, Italy;
- A sludge-amended soil from Barcelona, Spain
- A sludge-amended soil from Essen, Germany
- A long-term sludge exposed soil from Hohenheim, Germany

The following analytical information was gathered partly before and during the sampling of the raw materials, to be used for the production of the HORIZONTAL validation materials. The material were sampled by IES and shipped to IRMM in the course of the year 2005. The information gathered was then completed by various analytical screenings for PAHs and PCBs done by the Institute for Reference Materials and Measurements, Geel, Belgium, for phthalates done by UBA, Berlin, Germany, for PBDE done by IIQAB-CSIC, Barcelona, Spain, for trace elements and some selected major and minor elements by the Institute for Environment and Sustainability, Ispra, Italy.

The work compiled hereafter is based on the numerous additional efforts of the scientists working at various members of the consortium Project HORIZONTAL-Org and contributing organisations.

This work is gratefully acknowledged.

## 2 Overview on property values

### 2.1 *Sludge materials from Düsseldorf, Germany*

The various sewage sludge materials originate from various installations in the North Rhine Westphalia and were produced and sampled by staff from the Landesumweltamt (LUA) NRW under the responsibility from Dr. K. Furtmann.

In total, four sludge materials (Sludge A and D from a major municipal WWTP, Sludge B from a municipal WWTP with industrial input, and Sludge C from a municipal WWTP with high PCB-Content,) were obtained and will be blended to two final materials. Before sampling the following analytical data for a typical sample were received.

Table 1 – Analytical data obtained on an average sludge sample in LUA NRW (with courtesy of K. Furtmann, LUA, Düsseldorf)

<i>Parameter</i>	<i>Concentration</i>
PCB	120 ug/kg
DEHP	110 mg/kg
PAH	5 mg/kg (EPA)
PCDD/F	15 ng TE/kg
PBDE	400 ug/kg
NP	40 mg/kg
LAS	3 g/kg
AOX	300 mg/kg

Subsequent screening led to the information displayed hereafter. It should be stressed that the data were obtained as SCREENING information on the UNTREATED or partially treated raw materials. Therefore, the final target values, which are relevant for the validation intercomparison can be different.

Table 2 – Analytical data obtained on a first screening on the sludge samples from LUA NRW

	<i>Sewage sludge A Dusseldorf</i>	<i>sewage sludge D Dusseldorf</i>
<b>PCB (ng/g)</b>		
28	62	35
52	101	65
101	31	38
118	49	40
153	30	33
105	24	11
138	46	38
156	<1	<1
180	34	23
170	23	19
<b>PAH (ng/g)</b>		
Naphtalene	34	381
Acenaphtylene	15	43
Acenaphthene	81	108
Fluorene	94	1167
Phenantrene		3440
Anthracene	22	344
Flouranthene	316	4817
Pyrene	235	3011
Benz(a)anthracene	473	791
Chrysene	691	1078
Benz(b)fluoranthene	538	1688
Benz(k)fluoranthene	228	635
Benz(a)pyrene	383	1114
Indeno(1,2,3-c,d)pyrene	92	229
Dibenzo(a,h)anthracene	71	70
Benzo(g,h,i)perylene	80	185



Table 3 – Data on phthalate contents (with courtesy of S. Heise, UBA, Germany)

	<i>DiBP</i>	<i>DBP</i>	<i>DCHP</i>	<i>DEHP</i>	<i>Water</i>
	µg/g dm	µg/g dm	µg/g dm	µg/g dm	Wgt. %
Sludge D (1)		0.135		41.474	3.85
Sludge B (2)	0.538	0.034		30.634	5.47
Sludge A (3)	0.184	0.037		31.399	1.46
Sludge C (4)		0.354	1.528	6.678	2.29

Table 4 – Data on PDBE contents (with courtesy of D. Barceló and co-workers, IIQAB-CSIC, Barcelona, Spain)

	<i>Sludge 2</i> <i>(B)</i>
Tetra-BDE-47	55.4
Penta-BDE-100	9.59
Penta-BDE-99	69.4
Hexa-BDE-154	5.91
Hexa-BDE-153	7.72
Hepta-BDE-183	5.09
Octa-BDE-196	nq
Octa-BDE-197	nq
Octa-BDE-203	9.70
Deca-BDE-209	2216
TOTAL	2379

Table 5 – Screening data on some selected trace elements by ICP-AES after micro-wave assisted digestion using aqua regia (with courtesy of F. Sena, IES, Ispra, Spain). Note that these data are based on single measurements!

	<i>Cd</i>	<i>Co</i>	<i>Cr</i>	<i>Cu</i>	<i>Mn</i>	<i>Ni</i>	<i>Pb</i>	<i>Sb</i>	<i>Tl</i>	<i>V</i>	<i>Zn</i>
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Sludge 1 (D)	2.65	29.0	53.3	359	1231	33.8	78.4	4.38	< 0.05	23.2	786
Sludge 2 (B)	1.19	31.1	62.6	202	278	29.9	72.2	2.51	< 0.05	11.8	625
Sludge 3 (A)	1.68	36.0	62.1	332	847	41.6	119	4.51	< 0.05	11.6	1237
Sludge 4 (C)	5.63	19.8	116	273	726	51.1	473	6.18	< 0.05	44.4	2015

Table 6 – Screening data on some selected matrix constituents and elements by WDXRF (with courtesy of S. Vaccaro).

<i>Sample</i>	<i>SiO2 (%)</i>	<i>Al2O3 (%)</i>	<i>CaO (%)</i>	<i>K2O (%)</i>	<i>Fe2O3 (%)</i>	<i>MgO (%)</i>	<i>TiO2 (PPM)</i>	<i>S (PPM)</i>	<i>P2O5 (PPM)</i>
Sludge 1 (D)	21.54	5.8	8.44	0.99	10.3	1.01	4367	<15	50448
Sludge 2 (B)	10.67	3.66	6.92	0.46	14.91	0.77	5217	<15	57633
Sludge 3 (A)	7.31	6.63	6.84	0.35	12.87	0.68	3733	<15	60369
Sludge 4 (C)	43.79	9.65	5.27	1.63	5.22	1.07	5628	<15	23945

<i>Sample</i>	<i>Na2O (%)</i>	<i>Cl (PPM)</i>	<i>Pb (PPM)</i>	<i>Zn (PPM)</i>	<i>Cu (PPM)</i>	<i>Ni (PPM)</i>	<i>Mn (PPM)</i>	<i>Cr (PPM)</i>
Sludge 1 (D)	0.3	2403	101	1002	350	15	1944	132
Sludge 2 (B)	0.31	315	97	879	172	12	514	180
Sludge 3 (A)	0.31	1281	153	1567	265	16	1440	168
Sludge 4 (C)	0.55	231	628	2625	371	81	1101	244

## 2.2 Agricultural soil material from Reading, United Kingdom

The material was proposed by the University of Reading (S. Nortcliff) and was sampled from a site called “Frogmore Farm” which was featured in the “Metals” Report for HORIZONTAL. This site is close to Reading with soils developed on flintyloamy periglacial materials over Chalk, has a long and well documented history of sludge application. The focus of the work of Nortcliff *et al.* undertook at this site and the monitoring and control at the site (by Thames Water and the subsequent subsidiary bodies dealing with sludge application to soil) was on metals (and metal loads), with no analysis or indeed any form of investigation in to organics in the broadest sense.

The analytical information produced in the context of the screening of the raw material is displayed below.

Table 7 – Data on phthalate contents (with courtesy of S. Heise, UBA, Germany)

	<i>DiBP</i>	<i>DBP</i>	<i>DCHP</i>	<i>DEHP</i>	<i>Water</i>
	µg/g dm	µg/g dm	µg/g dm	µg/g dm	Wgt. %
Soil 3 (Reading)		0.032		0.119	6.69

Table 8 – Screening data on some selected trace elements by ICP-AES after micro-wave assisted digestion using aqua regia (with courtesy of F. Sena). Note that these data are based on single measurements!

	<i>Cd</i>	<i>Co</i>	<i>Cr</i>	<i>Cu</i>	<i>Mn</i>	<i>Ni</i>	<i>Pb</i>	<i>Sb</i>	<i>Tl</i>	<i>V</i>	<i>Zn</i>
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Soil 3 (Reading)	0.15	7.06	27.9	13.8	152	9.01	26.7	3.00	< 0.05	25.8	93.1

Table 9 – Analytical data obtained on a first screening on the sludge-amended soil from Reading (courtesy of IRMM)

<i>Parameter</i>	<i>Concentration</i>
<b>PCB</b>	<b>ng/g</b>
28	<1
52	<1
101	<1
118	<1
153	<1
105	<1
138	<1
156	<1
180	<1
170	<1
<b>PAH</b>	<b>ng/g</b>
Naphtalene	<10
Acenaphtylene	21
Acenaphthene	<10
Fluorene	<10
Phenantrene	<10
Anthracene	<10
Flouranthene	818
Pyrene	776
Benz(a)anthracene	565

<i>Parameter</i>	<i>Concentration</i>
Chrysene	608
Benz(b)fluoranthene	824
Benz(k)fluoranthene	329
Benz(a)pyrene	799
Indeno(1,2,3-c,d)pyrene	779
Dibenzo(a,h)anthracene	118
Benzo(g,h,i)perylene	394

*Table 10 – Data on PDBE contents (with courtesy of D. Barceló and co-workers, IIQAB-CSIC, Barcelona, Spain)*

	<i>Soil 3 (Reading)</i>
Tetra-BDE-47	nq
Penta-BDE-100	nq
Penta-BDE-99	1.03
Hexa-BDE-154	0.03
Hexa-BDE-153	nq
Hepta-BDE-183	nq
Octa-BDE-196	nq
Octa-BDE-197	nd
Octa-BDE-203	nd
Deca-BDE-209	272
TOTAL	273

*Table 11 – Screening data on some selected trace elements by ICP-AES after micro-wave assisted digestion using aqua regia (with courtesy of F. Sena). Note that these data are based on single measurements!*

	<i>Cd</i>	<i>Co</i>	<i>Cr</i>	<i>Cu</i>	<i>Mn</i>	<i>Ni</i>	<i>Pb</i>	<i>Sb</i>	<i>Tl</i>	<i>V</i>	<i>Zn</i>
Soil 3 (Reading)	0.15	7.06	27.9	13.8	152	9.01	26.7	3.00	< 0.05	25.8	93.1

*Table 12 – Screening data on some selected matrix constituents and elements by WDXRF (with courtesy of S. Vaccaro).*

<i>Sample</i>	<i>SiO2 (%)</i>	<i>Al2O3 (%)</i>	<i>CaO (%)</i>	<i>K2O (%)</i>	<i>Fe2O3 (%)</i>	<i>MgO (%)</i>	<i>TiO2 (PPM)</i>	<i>S (PPM)</i>	<i>P2O5 (PPM)</i>
Soil 3 (Reading)	79.36	4.77	1.12	0.96	1.94	0.17	4107	443	2102

<i>Sample</i>	<i>Na2O (%)</i>	<i>Cl (PPM)</i>	<i>Pb (PPM)</i>	<i>Zn (PPM)</i>	<i>Cu (PPM)</i>	<i>Ni (PPM)</i>	<i>Mn (PPM)</i>	<i>Cr (PPM)</i>
Soil 3 (Reading)	0.42	13	45	69	69	69	216	92

*Table 13 – Screening data on mercury by solid-sampling cold-vapour AAS using amalgamation enrichment (with courtesy of G. Locoro).*

<i>Sample</i>	<i>Hg µg/g</i>
Soil 3 (Reading)	0.12

### 2.3 Compost from Vienna, Austria

The fresh compost material was obtained from the Austrian Federal Environment Agency (UBA, Vienna), which had used a sub-batch of the raw material for national intercomparison. The remainder of the material was stored at 4°C until shipment to IRMM for further processing. The following analytical information was provided by UBA Austria and completed with various screenings.

Table 14 – Analytical data on compost material received from UBA Austria  
Inorganic and sum parameters

Parameter	Unit	Sample fraction used	Observed mean
B CAT	mg/l F.M.	Fresh sample, <10mm	6.1
K CAT	mg/l F.M.	Fresh sample, <10mm	2624
Mg CAT	mg/l F.M.	Fresh sample, <10mm	242
P CAT	mg/l F.M.	Fresh sample, <10mm	49
B CAT	% D.M.	Fresh sample, <10mm	0.0017
K CAT	% D.M.	Fresh sample, <10mm	0.72
Mg CAT	% D.M.	Fresh sample, <10mm	0.07
P CAT	% D.M.	Fresh sample, <10mm	0.01
NO <sub>3</sub> -N	mg/kg F.M.	Fresh sample, <10mm	3.5
NH <sub>4</sub> -N	mg/kg F.M.	Fresh sample, <10mm	230
Ctotal	% D.M.	<45° dry, milled	29
Corg	% D.M.	<45° dry, milled	27
Ntotal	% D.M.	<45° dry, milled	1.7
P	mg/kg D.M.	<45° dry, milled	2596
K	mg/kg D.M.	<45° dry, milled	11019
K	% D.M.	<45° dry, milled	1.10
B	mg/kg D.M.	<45° dry, milled	60
Cd	mg/kg D.M.	<45° dry, milled	0.46
Cr	mg/kg D.M.	<45° dry, milled	25
Cu	mg/kg D.M.	<45° dry, milled	46
Hg	mg/kg D.M.	<45° dry, milled	0.20
Ni	mg/kg D.M.	<45° dry, milled	18
Pb	mg/kg D.M.	<45° dry, milled	45
Zn	mg/kg D.M.	<45° dry, milled	198
Ca	mg/kg D.M.	<45° dry, milled	68776
Ca	% D.M.	<45° dry, milled	6.9
Mo	mg/kg D.M.	<45° dry, milled	0.8
S	mg/kg D.M.	<45° dry, milled	2137
Fe	mg/kg D.M.	<45° dry, milled	9959
Mn	mg/kg D.M.	<45° dry, milled	418
Na	mg/kg D.M.	<45° dry, milled	742
Co	mg/kg D.M.	<45° dry, milled	4.1
AOX	mg/kg D.M.	<30° dry, milled	62

Table 15 – Analytical data on compost material received from UBA Austria  
Polycyclic aromatic hydrocarbons

PAH	Unit	Result
Naphthaline	µg/kg DM	9.3
Acenaphthylene	µg/kg DM	8.6
Acenaphthene	µg/kg DM	5
Fluorene	µg/kg DM	8.0
Phenanthrene	µg/kg DM	89
Anthracene	µg/kg DM	27
Fluoranthene	µg/kg DM	487
Pyrene	µg/kg DM	380

<i>PAH</i>	<i>Unit</i>	<i>Result</i>
Benzo(a)anthracene	µg/kg DM	278
Chrysene	µg/kg DM	317
Benzo(b)fluoranthene	µg/kg DM	365
Benzo(k)fluoranthene	µg/kg DM	193
Benz(a)pyrene	µg/kg DM	320
Indeno(1,2,3-c,d)pyrene	µg/kg DM	233
Dibenz(a,h)anthracene	µg/kg DM	67
Benzo(g,h,i)perylene	µg/kg DM	225
Sum EPA	µg/kg DM	3013
Sum EPA	mg/kg DM	3.0

Table 16 – Analytical data on compost material received from UBA Austria  
Sum PCDDs and PCBs

<i>Parameter</i>			
Dioxine	TEQ (ITEF)	ng/kg DM	7.3
PCB	TEQ (WHO)	ng/kg DM	3.5
	Σ Ballschmiter	mg/kg DM	0.05

Table 17 – Analytical data on compost material obtained by screening in IRMM

<i>Parameter</i>	<i>Result in ng/g</i>
<b>PCB</b>	
28	2
52	2
101	4
118	3
153	10
105	1
138	8
156	1
180	5
170	<1
<b>PAH</b>	
Naphtalene	<10
Acenaphthylene	<10
Acenaphthene	<10
Fluorene	<10
Phenantrene	<10
Anthracene	26
Fluoranthene	611
Pyrene	510
Benzo(a)anthracene	888
Chrysene	957
Benzo(b)fluoranthene	1531
Benzo(k)fluoranthene	547
Benzo(a)pyrene	1101
Indeno(1,2,3-c,d)pyrene	416
Dibenzo(a,h)anthracene	81
Benzo(g,h,i)perylene	295

Table 18 – Data on PDBE contents (with courtesy of D. Barceló and co-workers, IIQAB-CSIC, Barcelona, Spain)

	Compost 1 (Vienna)
Tetra-BDE-47	4.02
Penta-BDE-100	0.19
Penta-BDE-99	2.59
Hexa-BDE-154	nq
Hexa-BDE-153	0.23
Hepta-BDE-183	0.04
Octa-BDE-196	nq
Octa-BDE-197	nq
Octa-BDE-203	1.44
Deca-BDE-209	17.4
TOTAL	25.9

Table 19 – Data on phthalate contents (with courtesy of S. Heise, UBA, Germany)

	DiBP	DBP	DCHP	DEHP	Water
	µg/g dm	µg/g dm	µg/g dm	µg/g dm	Wgt. %
Compost 1 (Vienna)		0.058		1.426	5.57

Table 20 – Screening data on some selected trace elements by ICP-AES after micro-wave assisted digestion using aqua regia (with courtesy of F. Sena). Note that these data are based on single measurements!

	Cd	Co	Cr	Cu	Mn	Ni	Pb	Sb	Tl	V	Zn
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Compost 1 (Vienna)	0.39	7.36	31.9	41.0	365	12.7	49.5	0.04	0.79	0.13	208

Table 21 – Screening data on some selected matrix constituents and elements by WDXRF (with courtesy of S. Vaccaro).

Sample	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	CaO (%)	K <sub>2</sub> O (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	TiO <sub>2</sub> (PPM)	S (PPM)	P <sub>2</sub> O <sub>5</sub> (PPM)
Compost 1 (Vienna)	20.63	4.31	6.17	4.26	1.99	2.49	1602	<15	10521

Sample	Na <sub>2</sub> O (%)	Cl (PPM)	Pb (PPM)	Zn (PPM)	Cu (PPM)	Ni (PPM)	Mn (PPM)	Cr (PPM)
Compost 1 (Vienna)	0.35	3496	81	375	79	55	653	60

Table 22 – Screening data on mercury by solid-sampling cold-vapour AAS using amalgamation enrichment (with courtesy of G. Locoro).

Sample	Hg µg/g
Compost 1 (Vienna)	0.17

## 2.4 Agricultural soil, sludge amended soil from Pavia, Italy

This sludge-amended soil material was obtained during a monitoring campaign, which aimed at a generic description of the over-all soil quality in Pavia Province, Italy. The material, which was collected from the upper horizon, originates from a small farm called “*Cascina Novello*”. During the characterisation of the site, the following analytical information was obtained on a pooled sample of a sub-area of the farm of 20 X 20 m<sup>2</sup>.

Table 23 – Analytical data on Pavia soil

<i>Parameter</i>	<i>Result</i>
Al	7.13 Wgt%
As	22.4 mg/kg
Cd	0.79 mg/kg
Cr	59 mg/kg
Cu	30.8 mg/kg
Hg	0.08 mg/kg
Ni	34.4 mg/kg
Pb	24.6 mg/kg
Zn	95 mg/kg
C	0.91 Wgt %
2,3,7,8-TCDD	0.047 pg/g
1,2,3,7,8-PeCDD	0.15 pg/g
1,2,3,4,7,8-HxCDD	0.19 pg/g
1,2,3,6,7,8-HxCDD	1.5 pg/g
1,2,3,7,8,9-HxCDD	0.74 pg/g
1,2,3,4,6,7,8-HpCDD	26 pg/g
OCDD	382 pg/g
2,3,7,8-TCDF	0.68 pg/g
1,2,3,7,8-PeCDF	0.53 pg/g
2,3,4,7,8-PeCDF	0.71 pg/g
1,2,3,4,7,8-HxDF	1.00 pg/g
1,2,3,6,7,8-HxDF	0.66 pg/g
2,3,4,6,7,8-HxDF	1.6 pg/g
1,2,3,7,8,9-HxDF	0.27 pg/g
1,2,3,4,6,7,8-HpDF	12 pg/g
1,2,3,4,7,8,9-HpDF	0.68 pg/g
OCDF	33 pg/g
I-TEQ	2.0 pg/g
WHO-TEQ	1.7 pg/g

In addition, the screening performed at IRMM did not reveal significant quantities of PCBs and PAHs, which were all below the LoDs (1 ng/g for PCBs and 10 ng/g for PAHs, respectively).

Table 24 – Data on phthalate contents (with courtesy of S. Heise, UBA, Germany)

	<i>DiBP</i>	<i>DBP</i>	<i>DCHP</i>	<i>DEHP</i>	<i>Water</i>
	µg/g TM	µg/g TM	µg/g TM	µg/g TM	Wgt. %
Soil 5 (Pavia)		0.005		0.011	1.54

Table 25 – Data on PDBE contents (with courtesy of D. Barceló and co-workers, IIQAB-CSIC, Barcelona, Spain)

	Soil 5 (Pavia)
Tetra-BDE-47	nq
Penta-BDE-100	nq
Penta-BDE-99	0.39
Hexa-BDE-154	nq
Hexa-BDE-153	nq
Hepta-BDE-183	0.08
Octa-BDE-196	nq
Octa-BDE-197	nd
Octa-BDE-203	nd
Deca-BDE-209	670
TOTAL	671

Table 26 – Screening data on some selected trace elements by ICP-AES after microwave assisted digestion using aqua regia (with courtesy of F. Sena). Note that these data are based on single measurements!

	Cd	Co	Cr	Cu	Mn	Ni	Pb	Sb	Tl	V	Zn
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Soil 5 (Pavia)	0.33	18.4	57.3	22.5	426	30.5	20.6	2.00	< 0.05	38.1	87.8

Table 27 – Screening data on some selected matrix constituents and elements by WDXRF (with courtesy of S. Vaccaro).

Sample	SiO <sub>2</sub> (%)	Al <sub>2</sub> O <sub>3</sub> (%)	CaO (%)	K <sub>2</sub> O (%)	Fe <sub>2</sub> O <sub>3</sub> (%)	MgO (%)	TiO <sub>2</sub> (PPM)	S (PPM)	P <sub>2</sub> O <sub>5</sub> (PPM)
Soil 5 (Pavia)	69.39	12.9	1.45	2.24	4.25	1.16	6118	255	1789

Sample	Na <sub>2</sub> O (%)	Cl (PPM)	Pb (PPM)	Zn (PPM)	Cu (PPM)	Ni (PPM)	Mn (PPM)	Cr (PPM)
Soil 5 (Pavia)	1.84	62	38	108	55	66	597	110

Table 28 – Screening data on mercury by solid-sampling cold-vapour AAS using amalgamation enrichment (with courtesy of G. Locoro).

Sample	Hg µg/g
Soil 5 (Pavia)	0.06



## 2.5 Sludge-amended-soil from Barcelona, Spain

The sludge-amended soil material from Barcelona sampled upon indication from the Barcelo'- Group in Barcelona.

Table 29 – Data on phthalate contents (with courtesy of S. Heise, UBA, Germany)

	<i>DiBP</i>	<i>DBP</i>	<i>DCHP</i>	<i>DEHP</i>	<i>Water</i>
	µg/g dm	µg/g dm	µg/g dm	µg/g dm	Wgt. %
Soil 2 (Lleida T.)		0.015		0.183	11.38

Table 30 – Data on PDBE contents (with courtesy of D. Barceló and co-workers, IIQAB-CSIC, Barcelona, Spain)

	<i>Soil 2</i> ( <i>Lleida T.</i> )
Tetra-BDE-47	nq
Penta-BDE-100	nq
Penta-BDE-99	1.59
Hexa-BDE-154	0.45
Hexa-BDE-153	nq
Hepta-BDE-183	0.48
Octa-BDE-196	1.60
Octa-BDE-197	nq
Octa-BDE-203	nq
Deca-BDE-209	1000
TOTAL	1004

Table 31 – Screening data on some selected trace elements by ICP-AES after micro-wave assisted digestion using aqua regia (with courtesy of F. Sena). Note that these data are based on single measurements!

	<i>Cd</i>	<i>Co</i>	<i>Cr</i>	<i>Cu</i>	<i>Mn</i>	<i>Ni</i>	<i>Pb</i>	<i>Sb</i>	<i>Tl</i>	<i>V</i>	<i>Zn</i>
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Soil 2 (Lleida T.)	0.59	14.1	32.7	53.6	405	18.6	18.4	2.24	< 0.05	31.8	111

Table 32 – Screening data on some selected matrix constituents and elements by WDXRF (with courtesy of S. Vaccaro).

<i>Sample</i>	<i>SiO2 (%)</i>	<i>Al2O3 (%)</i>	<i>CaO (%)</i>	<i>K2O (%)</i>	<i>Fe2O3 (%)</i>	<i>MgO (%)</i>	<i>TiO2 (PPM)</i>	<i>S (PPM)</i>	<i>P2O5 (PPM)</i>
Soil 2 (Lleida T.)	44.43	10.67	14.29	2.53	3.44	2.04	4116	780	3396

<i>Sample</i>	<i>Na2O (%)</i>	<i>Cl (PPM)</i>	<i>Pb (PPM)</i>	<i>Zn (PPM)</i>	<i>Cu (PPM)</i>	<i>Ni (PPM)</i>	<i>Mn (PPM)</i>	<i>Cr (PPM)</i>
Soil 2 (Lleida T.)	0.64	65	26	125	59	17	547	65

Table 33 – Screening data on mercury by solid-sampling cold-vapour AAS using amalgamation enrichment (with courtesy of G. Locoro).

<i>Sample</i>	<i>Hg µg/g</i>
Soil 2 (Lleida T.)	0.10

## 2.6 Sludge amended soil from Essen, Germany

The German sludge-amended soil from Essen, which was provided as the three sludge materials by LUA NRW, did not feature significant concentrations of the PCB congeners 28, 52, 101, 118, 153, 105, 138, 156, 180, 170, but had detectable amounts of some PAHs.

Table 34 – Analytical screening data on the German sludge-amended soil.

Parameter	Concentration (ng/g)
Naphtalene	<10
Acenaphtylene	<10
Acenaphthene	<10
Fluorene	<10
Phenantrene	<10
Anthracene	<10
Fluoranthene	28
Pyrene	20
Benz(a)anthracene	24
Chrysene	47
Benz(b)fluoranthene	76
Benz(k)fluoranthene	20
Benz(a)pyrene	35
Indeno(1,2,3-c,d)pyrene	35
Dibenzo(a,h)anthracene	10
Benzo(g,h,i)perylene	26

Table 35 – Data on phthalate contents (with courtesy of S. Heise, UBA, Germany)

	DiBP	DBP	DCHP	DEHP	Water
	µg/g dm	µg/g dm	µg/g dm	µg/g dm	Wgt. %
Soil 4 (Essen)		0.011		0.302	0.55

Table 36 – Data on PDBE contents (with courtesy of D. Barceló and co-workers, IIQAB-CSIC, Barcelona, Spain)

	Soil 4 (Essen)
Tetra-BDE-47	nq
Penta-BDE-100	nq
Penta-BDE-99	nq
Hexa-BDE-154	nq
Hexa-BDE-153	nq
Hepta-BDE-183	nq
Octa-BDE-196	nq
Octa-BDE-197	nq
Octa-BDE-203	1.28
Deca-BDE-209	19.1
TOTAL	20.3

Table 37 – Screening data on some selected trace elements by ICP-AES after micro-wave assisted digestion using aqua regia (with courtesy of F. Sena). Note that these data are based on single measurements!

	<i>Cd</i>	<i>Co</i>	<i>Cr</i>	<i>Cu</i>	<i>Mn</i>	<i>Ni</i>	<i>Pb</i>	<i>Sb</i>	<i>Tl</i>	<i>V</i>	<i>Zn</i>
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Soil 4 (Essen)	0.52	5.45	26.1	8.05	320	4.03	27.3	2.73	< 0.05	29.5	78.1

Table 38 – Screening data on some selected matrix constituents and elements by WDXRF (with courtesy of S. Vaccaro).

<i>Sample</i>	<i>SiO2 (%)</i>	<i>Al2O3 (%)</i>	<i>CaO (%)</i>	<i>K2O (%)</i>	<i>Fe2O3 (%)</i>	<i>MgO (%)</i>	<i>TiO2 (PPM)</i>	<i>S (PPM)</i>	<i>P2O5 (PPM)</i>
Soil 4 (Essen)	79.47	4.42	0.85	0.6	0.86	0.07	2163	189	2019

<i>Sample</i>	<i>Na2O (%)</i>	<i>Cl (PPM)</i>	<i>Pb (PPM)</i>	<i>Zn (PPM)</i>	<i>Cu (PPM)</i>	<i>Ni (PPM)</i>	<i>Mn (PPM)</i>	<i>Cr (PPM)</i>
Soil 4 (Essen)	0.45	19	42	87	683	60	462	61

Table 39 – Screening data on mercury by solid-sampling cold-vapour AAS using amalgamation enrichment (with courtesy of G. Locoro).

<i>Sample</i>	<i>Hg µg/g</i>
Soil 4 (Essen)	0.04

## 2.7 Long-term sludge exposed soil from Hohenheim-Stuttgart, Germany

Similarly, an additional sludge exposed soil was sampled at the University of Hohenheim, Stuttgart, where a test soil was long-term exposed to elevated concentrations of sewage sludge.

Table 40 – Data on phthalate contents (with courtesy of S. Heise, UBA, Germany)

	<i>DiBP</i>	<i>DBP</i>	<i>DCHP</i>	<i>DEHP</i>	<i>Water</i>
	µg/g TM	µg/g TM	µg/g TM	µg/g TM	Wgt. %
Soil 1 (Stuttgart)		0.045		0.263	17.65

Table 41 – Data on PDBE contents (with courtesy of D. Barceló and co-workers, IIQAB-CSIC, Barcelona, Spain)

	<i>Soil 1</i> <i>(Stuttgart)</i>
Tetra-BDE-47	nq
Penta-BDE-100	nq
Penta-BDE-99	2.30
Hexa-BDE-154	0.06
Hexa-BDE-153	0.04
Hepta-BDE-183	0.04
Octa-BDE-196	nq
Octa-BDE-197	nd
Octa-BDE-203	nd
Deca-BDE-209	498
TOTAL	500

Table 42 – Screening data on some selected trace elements by ICP-AES after micro-wave assisted digestion using aqua regia (with courtesy of F. Sena). Note that these data are based on single measurements!

	<i>Cd</i>	<i>Co</i>	<i>Cr</i>	<i>Cu</i>	<i>Mn</i>	<i>Ni</i>	<i>Pb</i>	<i>Sb</i>	<i>Tl</i>	<i>V</i>	<i>Zn</i>
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Soil 1 (Stuttgart)	0.69	12.7	36.1	26.2	504	18.3	25.2	2.62	<0.05	26.6	142

Table 43 – Screening data on some selected matrix constituents and elements by WDXRF (with courtesy of S. Vaccaro).

<i>Sample</i>	<i>SiO2 (%)</i>	<i>Al2O3 (%)</i>	<i>CaO (%)</i>	<i>K2O (%)</i>	<i>Fe2O3 (%)</i>	<i>MgO (%)</i>	<i>TiO2 (PPM)</i>	<i>S (PPM)</i>	<i>P2O5 (PPM)</i>
Soil 1 (Stuttgart)	71.94	10.06	1.33	1.86	3.66	0.88	7874	275	3571

<i>Sample</i>	<i>Na2O (%)</i>	<i>Cl (PPM)</i>	<i>Pb (PPM)</i>	<i>Zn (PPM)</i>	<i>Cu (PPM)</i>	<i>Ni (PPM)</i>	<i>Mn (PPM)</i>	<i>Cr (PPM)</i>
Soil 1 (Stuttgart)	1.23	50	47	212	85	69	991	129

Table 44 – Screening data on mercury by solid-sampling cold-vapour AAS using amalgamation enrichment (with courtesy of G. Locoro).

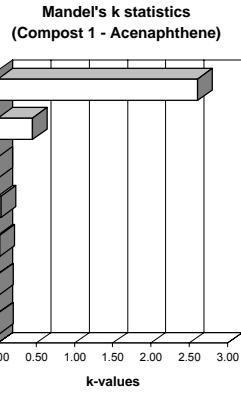
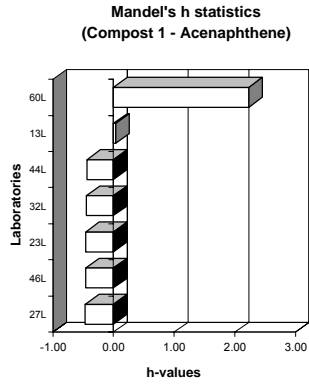
<i>Sample</i>	<i>Hg µg/g</i>
Soil 1 (Stuttgart)	1.77

## **Annex 3:**

### **Statistical calculations**



Sample: **Compost 1**  
 Element: **Acenaphthene**



Unit: ug/kg

Mandel's k statistics (Compost 1 - Acenaphthene)  
 Mandel's h statistics (Compost 1 - Acenaphthene)  
 Compost 1 - Acenaphthene -- Mean PARM = 5.51 [ug/kg]

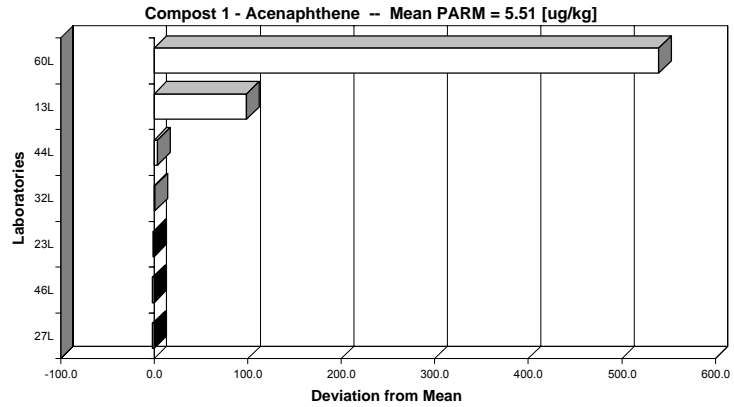
General calc.parm.  
 T1= 8.56445E+01  
 T2= 4.83811E+02  
 T3= 17  
 T4= 61  
 T5= 3.3836E+00  
 n= variabel  
 p= 5  
 N-table= 4

LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
27L	3.6750	0.096	4		-0.46	0.00	Fail		3.6750	0.0957		4	3	-1.83
46L	3.8611	0.218	4		-0.46	0.01	Fail		3.8611	0.2175		4	3	-1.65
23L	4.4750	0.556	4		-0.46	0.02	Fail		4.4750	0.5560		4	3	-1.03
32L	6.5333	1.069	3		-0.45	0.04	Fail		6.5333	1.0693		3	2	1.02
44L	9.0000		2		-0.44		Fail		9.0000			2	1	3.49
13L	104.2500	12.971	4		0.04	0.45			-		.13L	-	-	98.74
60L	545.0000	75.794	4	II	2.23	2.61	II	Fail	-		.60L	-	-	539.49
Tot.gem	96.685	12.958 ug/kg		1%-level:	1.98	(1.79)			5	5.5089	(13L,.60L)	5	4	
Tot.std=	201.093	28.104		5%-level:	1.71	(1.55)			2					

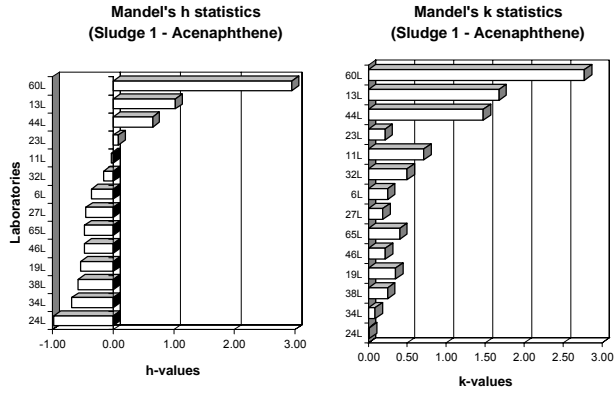
**RESULTS:** Mean = 5.50889 ug/kg

Repeatability variance S2r = 0.28197  
 Repeatability std. Sr = 0.53101 --> 9.64% r = 1.4868  
 Between lab variance S2L = 3.81860  
 Reproducibility var. S2R = 4.10057  
 Reproducibility std. SR = 2.02499 --> 36.76% R = 5.6700

Remarks: 2 Labs rejected! (13L,.60L)



Sample: **Sludge 1**  
 Element: **Acenaphthene**



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Acenaphthene)  
 Mandel's h statistics (Sludge 1 - Acenaphthene)  
 Sludge 1 - Acenaphthene -- Mean PARM = 87.24 [ug/kg]

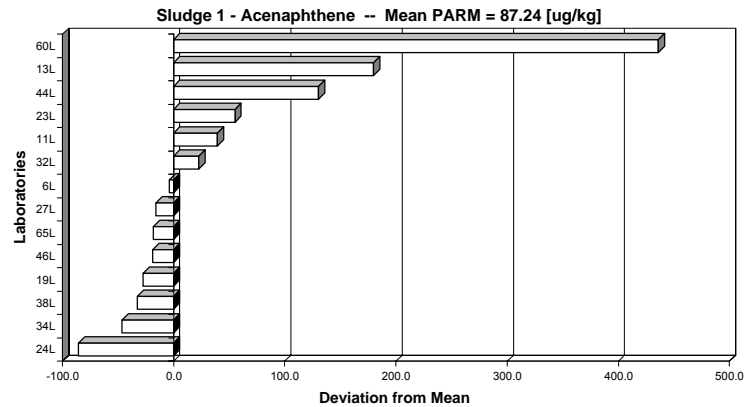
General calc.parm.  
 T1= 3.97377E+03  
 T2= 4.79728E+05  
 T3= 44  
 T4= 166  
 T5= 5.3837E+03  
 n= variabel 12  
 p= 12  
 N-table= 4

LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics		k-mark	AvX > AvST+2std	AvX < AvST-2std	End Result:						
					h	k				PARM	Stdev	Rej.labs	N	N-1	dev_mean	
24L	1.8000	0.283	2	-0.97	0.01				1.8000	0.2828		2	1	-85.44		
34L	40.7750	2.002	4	-0.68	0.09		Fail		40.7750	2.0023		4	3	-46.47		
38L	55.0000	5.774	4	-0.57	0.25		Fail		55.0000	5.7735		4	3	-32.24		
19L	60.0000	8.165	4	-0.54	0.35		Fail		60.0000	8.1650		4	3	-27.24		
46L	68.6517	5.061	4	-0.47	0.22		Fail		68.6517	5.0614		4	3	-18.59		
65L	69.0000	9.416	4	-0.47	0.40		Fail		69.0000	9.4163		4	3	-18.24		
27L	71.2500	4.349	4	-0.45	0.19		Fail		71.2500	4.3493		4	3	-15.99		
6L	83.3333	5.774	3	-0.36	0.25		Fail		83.3333	5.7735		3	2	-3.91		
32L	110.0000	11.547	4	-0.16	0.49				110.0000	11.5470		4	3	22.76		
11L	126.8200	16.668	3	-0.03	0.71				126.8200	16.6676		3	2	39.58		
23L	142.5000	5.000	4	0.08	0.21				142.5000	5.0000		4	3	55.26		
44L	217.7500	34.519	4	0.65	1.48		Fail		217.7500	34.5193		4	3	130.51		
13L	267.2500	39.152	4	1.02	1.68	I	Fail		-	-	,13L	-	-	180.01		
60L	523.0000	64.823	4	II	2.95	II	Fail		-	-	,60L	-	-	435.76		
Tot.gem	131.224	15.181 ug/kg		1%-level:	2.30	(1.87)			12	87.2400	(13L,60L)	12	11			
Tot.std=	132.887	18.412		5%-level:	1.85	(1.59)			2							

**RESULTS:** Mean = **87.24000** ug/kg

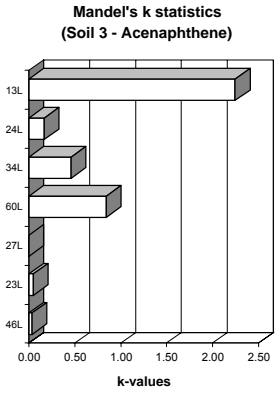
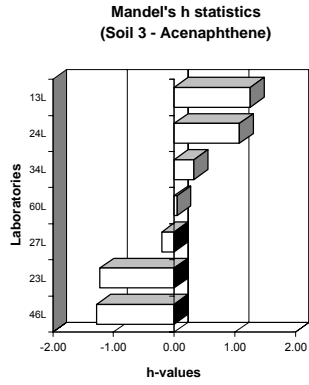
Repeatability variance S2r = 168.24209  
 Repeatability std. Sr = **12.97082** --> 14.87% r = 36.3183  
 Between lab variance S2L = 2958.06486  
 Reproducibility var. S2R = 3126.30695  
 Reproducibility std. SR = **55.91339** --> 64.09% R = 156.5575

Remarks: **2 Labs rejected! (13L,60L)**





Sample: **Soil 3**  
 Element: **Acenaphthene**



Unit: ug/kg

Mandel's k statistics (Soil 3 - Acenaphthene)  
 Mandel's h statistics (Soil 3 - Acenaphthene)  
 Soil 3 - Acenaphthene -- Mean PARM = 10.95 [ug/kg]

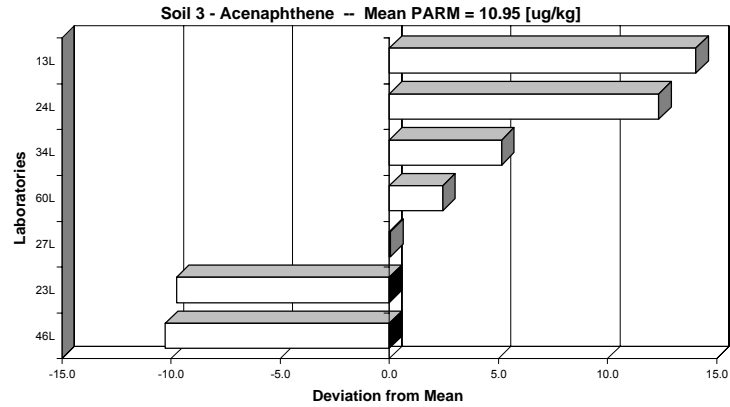
General calc.parm.  
 T1= 1.82456E+02  
 T2= 2.96903E+03  
 T3= 18  
 T4= 62  
 T5= 1.8355E+01  
 n= variabel 6  
 p= 3  
 N-table= 3

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{x} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	0.6852	0.086	3		-1.28	0.03		Fail	0.6852	0.0862		3	2	-10.26
23L	1.2000	0.115	4		-1.22	0.04		Fail	1.2000	0.1155		4	3	-9.75
27L	11.0000	-	1		-0.20				11.0000	-		1		0.05
60L	13.4000	2.156	4		0.05	0.84			13.4000	2.1556		4	3	2.45
34L	16.1000	1.180	4		0.33	0.46			16.1000	1.1804		4	3	5.15
24L	23.3000	0.424	2		1.08	0.17	Fail		23.3000	0.4243		2	1	12.35
13L	25.0000	5.774	4		1.25	2.25	II	Fail	-	-	13L	-	-	14.05
Tot.gem	12.955	1.623 ug/kg		1%-level:	1.98	(1.9)			6	10.9475	(13L)	6	5	
Tot.std=	9.615	2.181		5%-level:	1.71	(1.64)			1					

**RESULTS:** Mean = 10.94754 ug/kg

Repeatability variance S2r = 1.52957  
 Repeatability std. Sr = 1.23676 --> 11.30% r = 3.4629  
 Between lab variance S2L = 76.39229  
 Reproducibility var. S2R = 77.92186  
 Reproducibility std. SR = 8.82734 --> 80.63% R = 24.7165

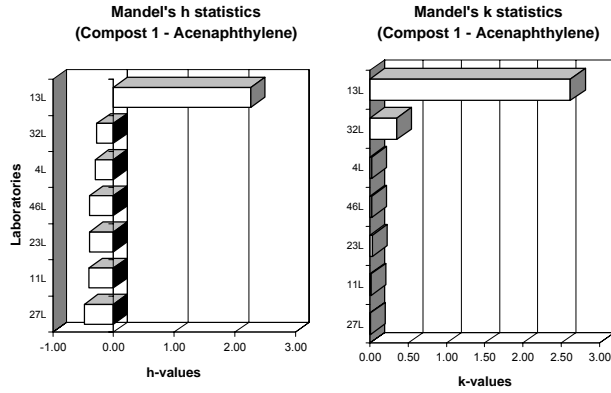
Remarks: 1 Lab rejected! (13L)



Sample: **Compost 1**  
 Element: **Acenaphthylene**

Unit:  $\mu\text{g}/\text{kg}$

Mandel's k statistics (Compost 1 - Acenaphthylene)  
 Mandel's h statistics (Compost 1 - Acenaphthylene)  
 Compost 1 - Acenaphthylene -- Mean PARM = 16.78  $[\mu\text{g}/\text{kg}]$



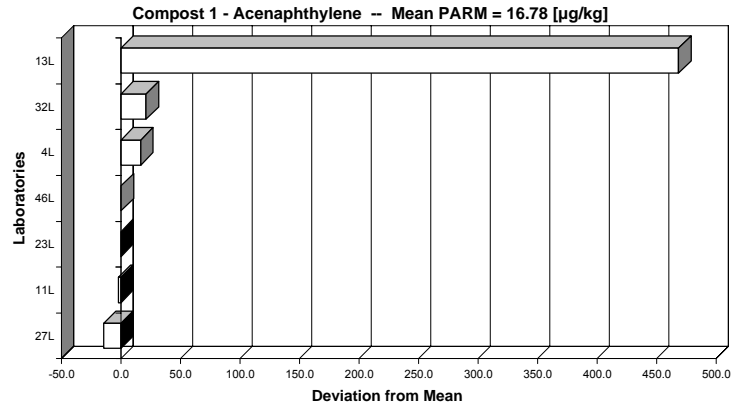
General calc.parm.  
 T1= 3.18435E+02  
 T2= 7.33124E+03  
 T3= 19  
 T4= 73  
 T5= 5.0646E+01  
 n= variabel 5  
 p= 5  
 N-table= 4

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > \text{AvST}+2\text{std}$	$\text{AvX} < \text{AvST}-2\text{std}$	PARM	Stdev	Rej.labs	N	N-1	dev_mean
27L	2.1500	0.100	4		-0.48	0.00			2.1500	0.1000		4	3	-14.63
11L	14.5875	1.345	4		-0.41	0.01			14.5875	1.3450		4	3	-2.19
23L	16.5000	2.887	4		-0.40	0.03			16.5000	2.8868		4	3	-0.28
46L	17.1617	2.365	3		-0.39	0.03			17.1617	2.3652		3	2	0.38
4L	33.5000	1.732	4		-0.30	0.02			33.5000	1.7321		4	3	16.72
32L	38.0000	33.151	3		-0.28	0.35			-	-	.32L	-	-	21.22
13L	485.2500	247.711	4	II	2.26	2.62	II	Fail	-	-	.13L	-	-	468.47
Tot.gem	86.736	41.327 $\mu\text{g}/\text{kg}$		1%-level:	1.98	(1.79)			5	16.7798	(13L, .32L)	5	4	
Tot.stdev	176.142	91.763		5%-level:	1.71	(1.55)			2					

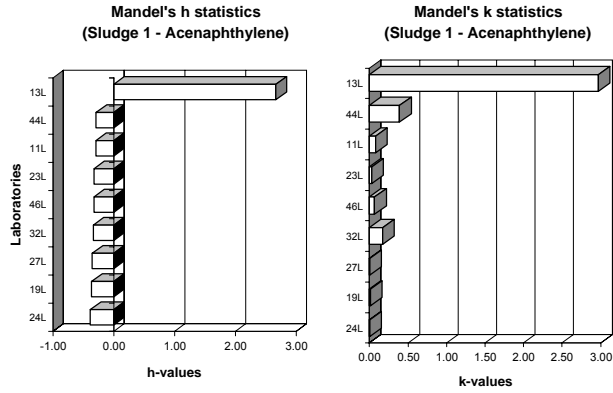
**RESULTS:** Mean = 16.77984  $\mu\text{g}/\text{kg}$

Repeatability variance S2r = 3.61755  
 Repeatability std. Sr = 1.90199 --> 11.33% r = 5.3256  
 Between lab variance S2L = 130.61722  
 Reproducibility var. S2R = 134.23477  
 Reproducibility std. SR = 11.58597 --> 69.05% R = 32.4407

Remarks: 2 Labs rejected! (13L, .32L)



Sample: **Sludge 1**  
 Element: **Acenaphthylene**



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Acenaphthylene)  
 Mandel's h statistics (Sludge 1 - Acenaphthylene)  
 Sludge 1 - Acenaphthylene -- Mean PARM = 29.6 [ug/kg]

General calc.parm.  
 T1= 8.25780E+02  
 T2= 3.36124E+04  
 T3= 26  
 T4= 100  
 T5= 2.0009E+03  
 n= variabel 7  
 p= 7  
 N-table= 4

				Mandel's statistics				End Result:						
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
24L	1.5000	0.707	2		-0.38	0.01		Fail	1.5000	0.7071		2	1	-28.10
19L	13.7000	2.005	4		-0.36	0.02		Fail	13.7000	2.0050		4	3	-15.90
27L	20.5000	1.000	4		-0.35	0.01			20.5000	1.0000		4	3	-9.10
32L	33.0000	21.772	4		-0.33	0.17			33.0000	21.7715		4	3	3.40
46L	38.6750	8.424	4		-0.33	0.07			38.6750	8.4245		4	3	9.08
23L	39.2500	3.594	4		-0.33	0.03			39.2500	3.5940		4	3	9.65
11L	60.5700	10.192	4		-0.29	0.08			60.5700	10.1920		4	3	30.97
44L	65.0000	49.497	2		-0.29	0.39			-	-	.44L	-	-	35.40
13L	2065.0000	375.502	4	II	2.67	2.97	II	Fail	-	-	.13L	-	-	2035.40
Tot.gem	259.688	52.522 ug/kg			1%-level: 2.13	(1.82)			7	29.5993	(13L,44L)	7	6	
Tot.std=	677.303	122.113			5%-level: 1.78	(1.57)			2					

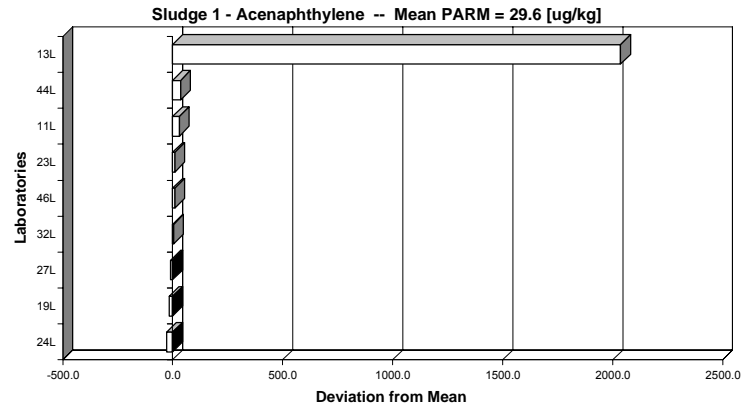
**RESULTS:** Mean = **29.59928** ug/kg

Repeatability variance **S2r = 105.30808**  
 Repeatability std. **Sr = 10.26197** --> 34.67% **r = 28.7335**

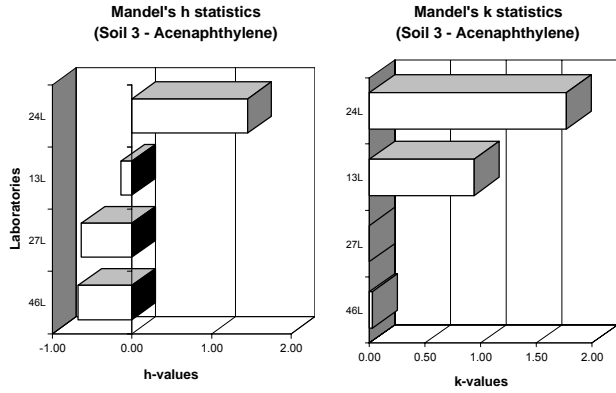
Between lab variance **S2L = 304.83076**  
 Reproducibility var. **S2R = 410.13885** --> 68.42% **R = 56.7053**

Reproducibility std. **SR = 20.25189**

Remarks: **2 Labs rejected! (13L,44L)**



Sample: **Soil 3**  
 Element: **Acenaphthylene**



Unit:  $\mu\text{g}/\text{kg}$

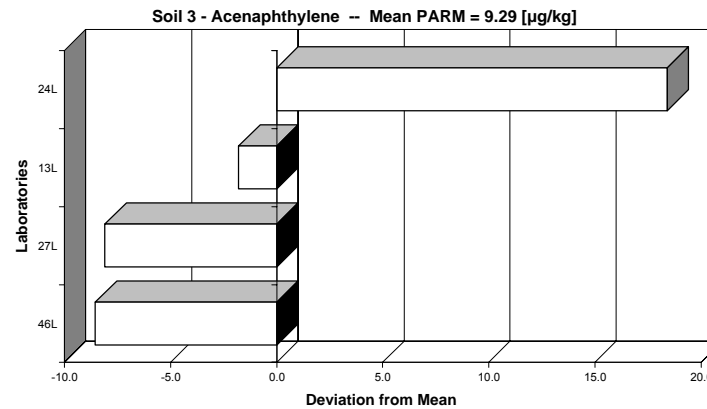
Mandel's k statistics (Soil 3 - Acenaphthylene)  
 Mandel's h statistics (Soil 3 - Acenaphthylene)  
 Soil 3 - Acenaphthylene -- Mean PARM = 9.29 [ $\mu\text{g}/\text{kg}$ ]

General calc.parm.  
 T1= 9.31871E+01  
 T2= 1.76757E+03  
 T3= 14  
 T4= 52  
 T5= 1.9587E+01  
 n= variabel  
 p= 4  
 N-table= 4

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > \text{AvST}+2\text{std}$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	0.7468	0.049	4		-0.67	0.03		Fail	0.7468	0.0494		4	3	-8.54
27L	1.2000		4		-0.64			Fail	1.2000			4	3	-8.09
13L	7.5000	1.732	4		-0.14	0.94			7.5000	1.7321		4	3	-1.79
24L	27.7000	3.253	2	!	1.45	1.77	!	Fail	27.7000	3.2527		2	1	18.41
Tot.gem	9.287	1.259 $\mu\text{g}/\text{kg}$			1% -level:	1.49			4	9.2867	()	4	3	
Tot.std=	12.657	1.554			5% -level:	1.42								

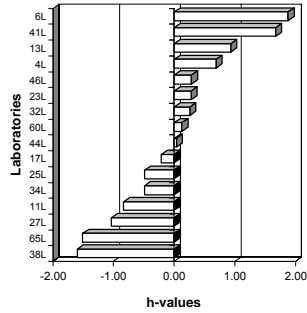
RESULTS: Mean = 9.28669  $\mu\text{g}/\text{kg}$

Repeatability variance S2r = 1.95873  
 Repeatability std. Sr = 1.39955 --> 15.07% r = 3.9187  
 Between lab variance S2L = 110.97143  
 Reproducibility var. S2R = 112.93016  
 Reproducibility std. SR = 10.62686 --> 114.43% R = 29.7552  
 Remarks: none

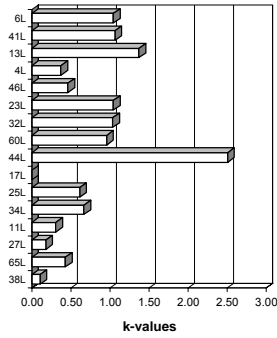


Sample: **Compost 1**  
 Element: **Anthracene**

Mandel's h statistics  
 (Compost 1 - Anthracene)



Mandel's k statistics  
 (Compost 1 - Anthracene)



Unit: µg/kg

Mandel's k statistics (Compost 1 - Anthracene)  
 Mandel's h statistics (Compost 1 - Anthracene)  
 Compost 1 - Anthracene -- Mean PARM = 31.78 [µg/kg]

General calc.parm.  
 T1= 1.76532E+03  
 T2= 6.30645E+04  
 T3= 56  
 T4= 218  
 T5= 7.6491E+02  
 n= variabel 15  
 p= 4  
 N-table= 4

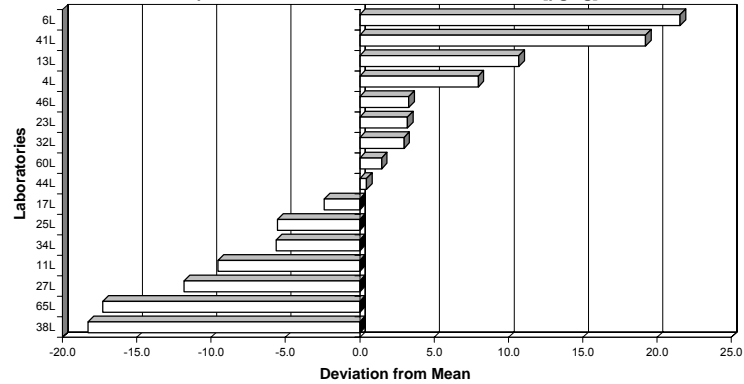
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
38L	13.5000	0.577	4		-1.60	0.10		Fail	13.5000	0.5774		4	3	-18.28
65L	14.5000	2.380	4		-1.51	0.43		Fail	14.5000	2.3805		4	3	-17.28
27L	19.9750	1.008	4		-1.03	0.18		Fail	19.9750	1.0079		4	3	-11.81
11L	22.2550	1.692	4		-0.83	0.31		Fail	22.2550	1.6920		4	3	-9.53
34L	26.1750	3.693	4		-0.49	0.67			26.1750	3.6927		4	3	-5.61
25L	26.2500	3.403	4		-0.48	0.62			26.2500	3.4034		4	3	-5.53
17L	29.4000	-	1		-0.21				29.4000	-		1		-2.38
44L	32.2500	13.865	4		0.04	2.51	II		-	.44L				0.47
60L	33.2500	5.315	4		0.13	0.96			33.2500	5.3151		4	3	1.47
32L	34.7500	5.737	4		0.26	1.04			34.7500	5.7373		4	3	2.97
23L	35.0000	5.774	4		0.28	1.04			35.0000	5.7735		4	3	3.22
46L	35.0755	2.562	4		0.28	0.46			35.0755	2.5622		4	3	3.29
4L	39.7500	2.062	4		0.69	0.37		Fail	39.7500	2.0616		4	3	7.97
13L	42.5000	7.594	4		0.93	1.37		Fail	42.5000	7.5939		4	3	10.72
41L	51.0000	5.888	4		1.67	1.07		Fail	51.0000	5.8878		4	3	19.22
6L	53.3333	5.774	3	I	1.88	1.04		Fail	53.3333	5.7735		3	2	21.55
Tot.gem	31.810	4.488 µg/kg			2.33	(1.87)			15	31.7809	(44L)	15	14	
Tot.std	11.476	3.340			1.86	(1.59)			1					

RESULTS: Mean = 31.78092 µg/kg

Repeatability variance S2r = 18.65622  
 Repeatability std. Sr = 4.31928 --> 13.59% r = 12.0940  
 Between lab variance S2L = 137.29437  
 Reproducibility var. S2R = 155.95059  
 Reproducibility std. SR = 12.48802 --> 39.29% R = 34.9664

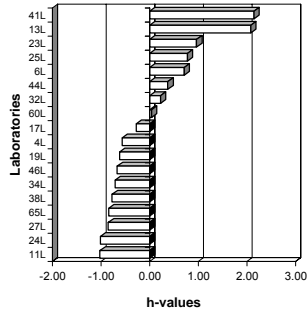
Remarks: 1 Lab rejected! (44L)

Compost 1 - Anthracene -- Mean PARM = 31.78 [µg/kg]

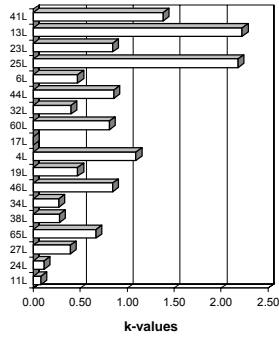


Sample: **Sludge 1**  
 Element: **Anthracene**

Mandel's h statistics  
(Sludge 1 - Anthracene)



Mandel's k statistics  
(Sludge 1 - Anthracene)



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Anthracene)  
 Mandel's h statistics (Sludge 1 - Anthracene)  
 Sludge 1 - Anthracene -- Mean PARM = 227.7 [ug/kg]

General calc.parm.  
 T1= 1.55365E+04  
 T2= 4.23002E+06  
 T3= 67  
 T4= 261  
 T5= 2.0955E+04  
 n= variabel 18  
 p= 18  
 N-table= 4

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
11L	128.0900	1.595	4		-1.02	0.08		Fail	128.0900	1.5949		4	3	-99.65
24L	128.8500	2.333	2		-1.01	0.12		Fail	128.8500	2.3335		2	1	-98.89
27L	144.7500	7.974	4		-0.85	0.39		Fail	144.7500	7.9739		4	3	-82.99
65L	145.2500	13.475	4		-0.84	0.66		Fail	145.2500	13.4753		4	3	-82.49
38L	152.5000	5.886	4		-0.77	0.28		Fail	152.5000	5.8862		4	3	-75.24
34L	157.8500	5.487	4		-0.71	0.27		Fail	157.8500	5.4873		4	3	-69.89
46L	162.5000	17.078	4		-0.67	0.84		Fail	162.5000	17.0783		4	3	-65.24
19L	167.5000	9.574	4		-0.62	0.47		Fail	167.5000	9.5743		4	3	-60.24
4L	172.5000	22.174	4		-0.56	1.09		Fail	172.5000	22.1736		4	3	-55.24
17L	201.0000	-	1		-0.27			Fail	201.0000	-		1		-26.74
60L	231.2500	16.399	4		0.04	0.81			231.2500	16.3987		4	3	3.51
32L	250.0000	8.165	4		0.23	0.40			250.0000	8.1650		4	3	22.26
44L	264.5000	17.369	4		0.38	0.86		Fail	264.5000	17.3696		4	3	36.76
6L	297.5000	9.574	4		0.71	0.47		Fail	297.5000	9.5743		4	3	69.76
25L	304.0000	44.204	4		0.78	2.18	!!	Fail	304.0000	44.2041		4	3	76.26
23L	322.5000	17.078	4		0.97	0.84		Fail	322.5000	17.0783		4	3	94.76
13L	430.7500	45.125	4	I	2.08	2.23	!!	Fail	430.7500	45.1248		4	3	203.01
41L	438.0000	28.059	4	I	2.15	1.38	Fail	Fail	438.0000	28.0595		4	3	210.26
Tot.gem	227.738	15.962 ug/kg			1%-level:	2.36 (1.88)			18	227.7383	()	18	17	
Tot.std=	97.782	12.888			5%-level:	1.88 (1.59)								

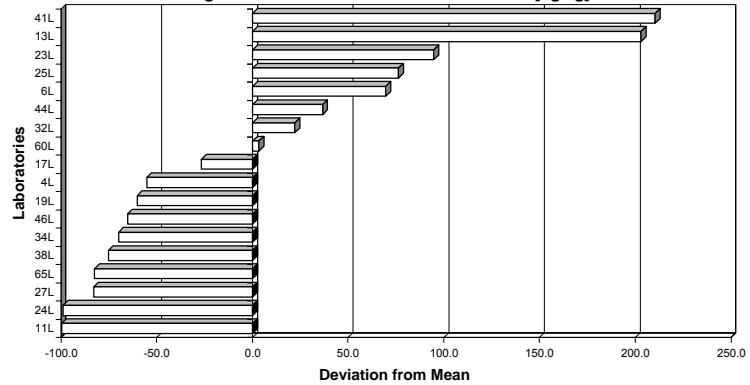
RESULTS: Mean = 227.73833 ug/kg

Repeatability variance S2r = 427.66134  
 Repeatability std. Sr = 20.67997 --> 9.08% r = 57.9039

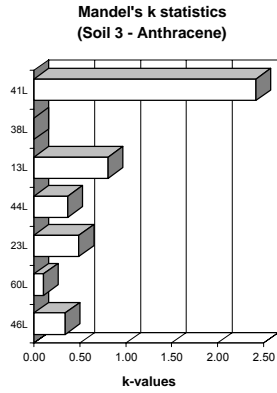
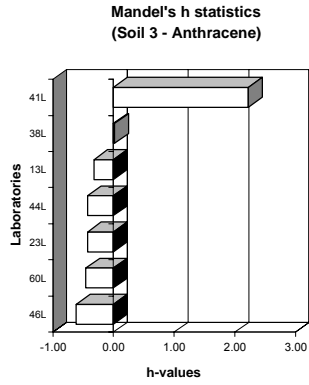
Between lab variance S2L = 9825.60699  
 Reproducibility var. S2R = 10253.26833  
 Reproducibility std. SR = 101.25842 --> 44.46% R = 283.5236

Remarks: none

Sludge 1 - Anthracene -- Mean PARM = 227.7 [ug/kg]



Sample: **Soil 3**  
 Element: **Anthracene**



Unit:  $\mu\text{g}/\text{kg}$

Mandel's k statistics (Soil 3 - Anthracene)  
 Mandel's h statistics (Soil 3 - Anthracene)  
 Soil 3 - Anthracene -- Mean PARM = 2.15 [ $\mu\text{g}/\text{kg}$ ]

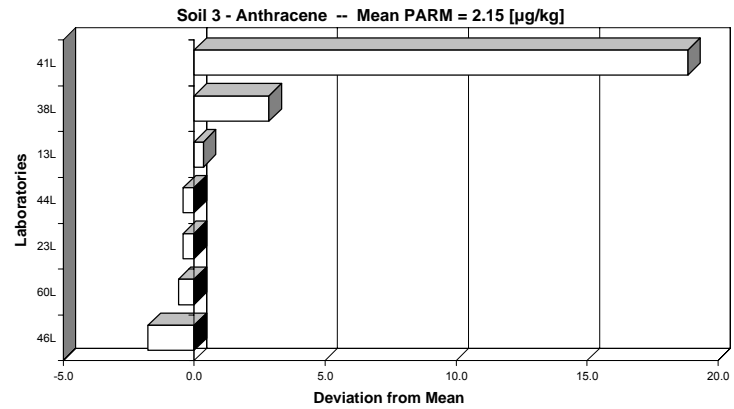
General calc.parm.  
 T1= 3.84650E+01  
 T2= 1.04222E+02  
 T3= 20  
 T4= 72  
 T5= 1.7591E+00  
 n= variabel 6  
 p= 3  
 N-table= 3

LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics		k-mark $\sqrt{x} > \text{AvST}+2\text{std}$	AvX < AvST-2std	End Result:			N	N-1	dev_mean
					h	k			PARM	Stdev	Rej.labs			
46L	0.3912	0.244	4		-0.61	0.34		Fail	0.3912	0.2444		4	3	-1.76
60L	1.5500	0.071	2		-0.45	0.10		Fail	1.5500	0.0707		2	1	-0.60
23L	1.7250	0.350	4		-0.43	0.49		Fail	1.7250	0.3500		4	3	-0.42
44L	1.7250	0.263	4		-0.43	0.37		Fail	1.7250	0.2630		4	3	0.35
13L	2.5000	0.577	4		-0.32	0.81		Fail	2.5000	0.5774		4	3	0.35
38L	5.0000		2		0.02				5.0000			2	1	2.85
41L	21.0000	1.732	3	II	2.22	2.42	II	Fail	-	-	41L	-	-	18.85
Tot.gem	4.842	0.462 $\mu\text{g}/\text{kg}$		1%-level:	1.98	(1.94)			6	2.1485	(41L)	6	5	
Tot.std=	7.265	0.591		5%-level:	1.71	(1.66)			1					

**RESULTS:** Mean = 2.1485  $\mu\text{g}/\text{kg}$

Repeatability variance S2r = 0.12565  
 Repeatability std. Sr = 0.35447 --> 16.50% r = 0.9925  
 Between lab variance S2L = 1.80587  
 Reproducibility var. S2R = 1.93153  
 Reproducibility std. SR = 1.38979 --> 64.69% R = 3.8914

Remarks: 1 Lab rejected! (41L)

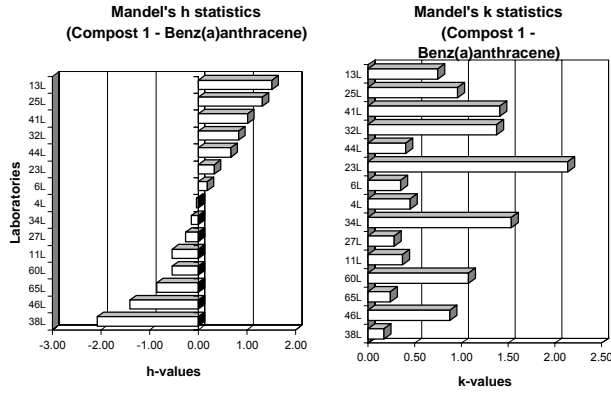


Sample: Compost 1  
 Element: Benz(a)anthracene

Unit: µg/kg

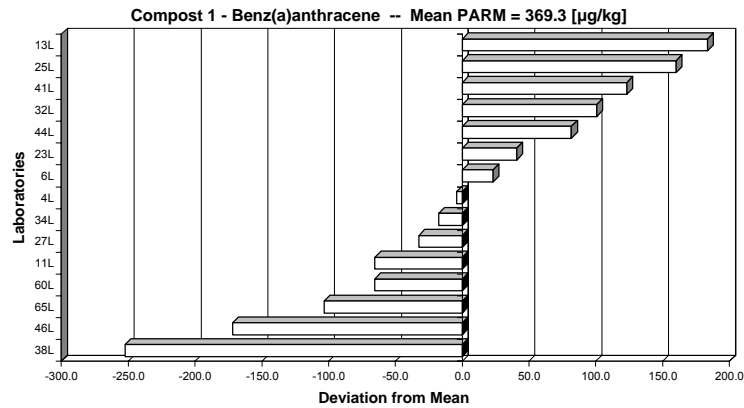
Mandel's k statistics (Compost 1 - Benz(a)anthracene)  
 Mandel's h statistics (Compost 1 - Benz(a)anthracene)  
 Compost 1 - Benz(a)anthracene -- Mean PARM = 369.3 [µg/kg]

General calc.parm.  
 T1= 2.21590E+04  
 T2= 9.01255E+06  
 T3= 60  
 T4= 240  
 T5= 1.5467E+05  
 n= variabel  
 p= 15  
 N-table= 4



Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > \text{AvST}+2\text{std}$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
38L	117.0000	10.132	4	!	-2.07	0.17		Fail	117.0000	10.1325		4	3	-252.32
46L	197.5000	51.235	4		-1.41	0.87		Fail	197.5000	51.2348		4	3	-171.82
65L	266.0000	14.283	4		-0.85	0.24		Fail	266.0000	14.2829		4	3	-103.32
60L	303.7500	63.042	4		-0.54	1.08		Fail	303.7500	63.0417		4	3	-65.57
11L	303.9200	21.764	4		-0.54	0.37		Fail	303.9200	21.7642		4	3	-65.40
27L	336.8750	16.390	4		-0.27	0.28			336.8750	16.3901		4	3	-32.44
34L	351.7000	89.978	4		-0.14	1.53			351.7000	89.9783		4	3	-17.62
4L	365.0000	26.458	4		-0.04	0.45			365.0000	26.4575		4	3	-4.32
6L	392.5000	20.616	4		0.19	0.35			392.5000	20.6155		4	3	23.18
23L	410.0000	125.167	4		0.33	2.13	!!		410.0000	125.1666		4	3	40.68
44L	451.0000	23.917	4		0.67	0.41		Fail	451.0000	23.9165		4	3	81.68
32L	470.0000	80.829	4		0.83	1.38		Fail	470.0000	80.8290		4	3	100.68
41L	492.5000	82.626	4		1.01	1.41		Fail	492.5000	82.6257		4	3	123.18
25L	529.2500	56.293	4		1.31	0.96		Fail	529.2500	56.2931		4	3	159.93
13L	552.7500	43.828	4		1.51	0.75		Fail	552.7500	43.8283		4	3	183.43
Tot.gem	369.316	48.437 µg/kg		1%-level:	2.32	(1.87)			15	369.3163	()	15	14	
Tot.std=	121.661	34.191		5%-level:	1.86	(1.59)								

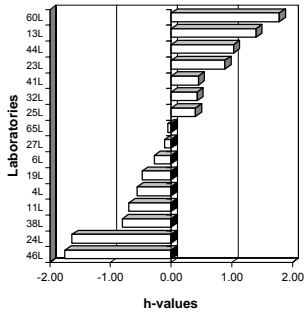
RESULTS: Mean = 369.31633 µg/kg  
 Repeatability variance S2r = 3437.21102  
 Repeatability std. Sr = 58.62773 --> 15.87% r = 164.1577  
 Between lab variance S2L = 13942.02928  
 Reproducibility var. S2R = 17379.24030  
 Reproducibility std. SR = 131.83035 --> 35.70% R = 369.1250  
 Remarks: none



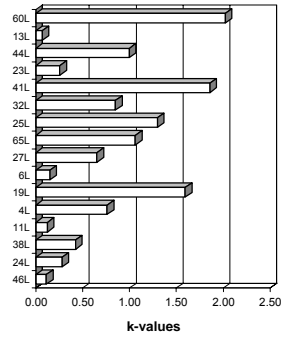


Sample: **Sludge 1**  
 Element: **Benz(a)anthracene**

**Mandel's h statistics**  
 (Sludge 1 - Benz(a)anthracene)



**Mandel's k statistics**  
 (Sludge 1 - Benz(a)anthracene)



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Benz(a)anthracene)  
 Mandel's h statistics (Sludge 1 - Benz(a)anthracene)  
 Sludge 1 - Benz(a)anthracene -- Mean PARM = 977.1 [ug/kg]

General calc.parm.  
 T1= 6.02625E+04  
 T2= 6.46615E+07  
 T3= 60  
 T4= 230  
 T5= 8.8175E+05  
 n= variabel  
 p= 16  
 N-table= 4

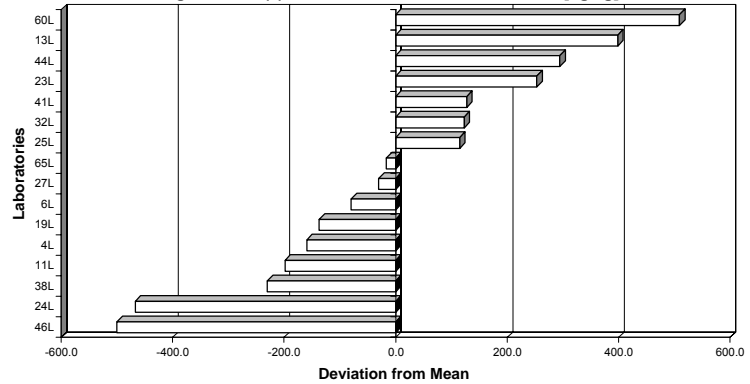
Mandel's statistics										End Result:					
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark	AvX > AvST+2std	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	476.6667	15.275	3		-1.75	0.11		Fail		476.6667	15.2753		3	2	-500.47
24L	509.6500	37.689	2		-1.63	0.28		Fail		509.6500	37.6888		2	1	-467.49
38L	746.5000	57.582	4		-0.81	0.42		Fail		746.5000	57.5818		4	3	-230.64
11L	778.4100	16.450	3		-0.69	0.12		Fail		778.4100	16.4499		3	2	-198.73
4L	817.5000	103.401	4		-0.56	0.76				817.5000	103.4005		4	3	-159.64
19L	840.0000	216.487	4		-0.48	1.59	I			840.0000	216.4871		4	3	-137.14
6L	897.5000	20.616	4		-0.28	0.15				897.5000	20.6155		4	3	-79.64
27L	947.0000	88.615	4		-0.11	0.65				947.0000	88.6153		4	3	-30.14
65L	960.7500	144.121	4		-0.06	1.06				960.7500	144.1212		4	3	-16.39
25L	1092.0000	176.439	4		0.40	1.30				1092.0000	176.4388		4	3	114.86
32L	1100.0000	115.470	4		0.43	0.85				1100.0000	115.4701		4	3	122.86
41L	1104.7500	252.549	4		0.45	1.86	I			1104.7500	252.5488		4	3	127.61
23L	1230.0000	34.641	4		0.88	0.26		Fail		1230.0000	34.6410		4	3	252.86
44L	1271.7500	135.296	4		1.03	1.00		Fail		1271.7500	135.2957		4	3	294.61
13L	1375.5000	9.256	4		1.39	0.07		Fail		1375.5000	9.2556		4	3	398.36
60L	1486.2500	274.495	4		1.78	2.02	II	Fail		1486.2500	274.4951		4	3	509.11
Tot.gem	977.139	106.149 ug/kg		1%-level:	2.33	(1.88)				16	977.1392	()	16	15	
Tot.std	285.973	87.464		5%-level:	1.86	(1.59)									

**RESULTS:** Mean = **977.13917** ug/kg

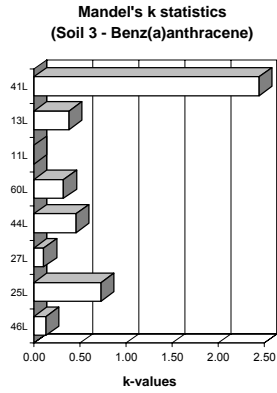
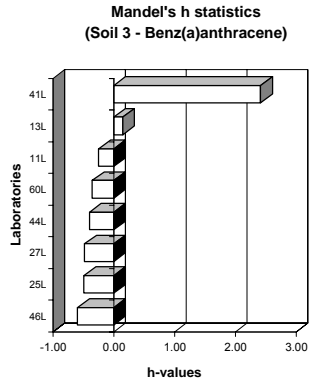
Repeatability variance **S2r = 20039.66608**  
 Repeatability std. **Sr = 141.56153** --> 14.49% **r = 396.3723**  
 Between lab variance **S2L = 68273.15023**  
 Reproducibility var. **S2R = 88312.81631**  
 Reproducibility std. **SR = 297.17472** --> 30.41% **R = 832.0892**

Remarks: none

**Sludge 1 - Benz(a)anthracene -- Mean PARM = 977.1 [ug/kg]**



Sample: **Soil 3**  
 Element: **Benz(a)anthracene**



Unit: µg/kg

Mandel's k statistics (Soil 3 - Benz(a)anthracene)  
 Mandel's h statistics (Soil 3 - Benz(a)anthracene)  
 Soil 3 - Benz(a)anthracene -- Mean PARM = 2.76 [µg/kg]

General calc.parm.  
 T1= 6.44555E+01  
 T2= 2.43289E+02  
 T3= 24  
 T4= 90  
 T5= 4.9146E+00  
 n= variabel 7  
 p= 7  
 N-table= 3

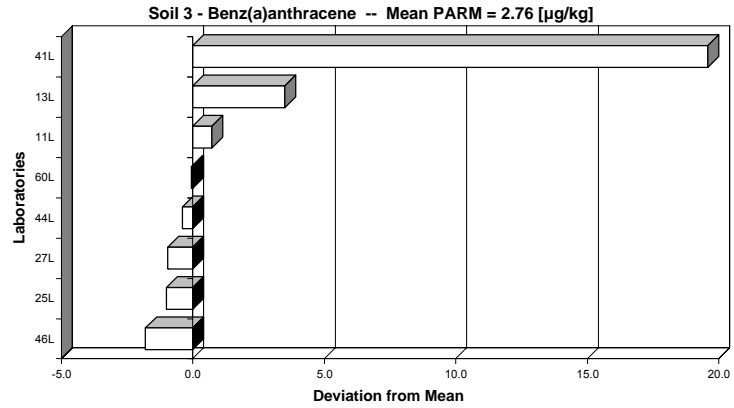
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	0.9689	0.171	4		-0.60	0.13		Fail	0.9689	0.1712		4	3	-1.79
25L	1.7500	0.957	4		-0.49	0.73		Fail	1.7500	0.9574		4	3	-1.01
27L	1.8000	0.141	4		-0.48	0.11		Fail	1.8000	0.1414		4	3	-0.96
44L	2.3667	0.603	3		-0.40	0.46		Fail	2.3667	0.6028		3	2	-0.39
60L	2.7000	0.424	4		-0.35	0.32		Fail	2.7000	0.4243		4	3	-0.06
11L	3.4800	-	1		-0.24	-			3.4800	-		1		0.72
13L	6.2500	0.500	4		0.15	0.38			6.2500	0.5000		4	3	3.49
41L	22.3333	3.215	3	II	2.41	2.45	II	Fail	-	-	.41L	-	-	19.57
Tot.gem	5.206	0.859 µg/kg		1%-level:	2.06	(1.94)			7	2.7594		7	6	
Tot.std=	7.104	1.075		5%-level:	1.75	(1.66)			1					

RESULTS: Mean = 2.75936 µg/kg

Repeatability variance S2r = 0.28910  
 Repeatability std. Sr = 0.53768 --> 19.49% r = 1.5055

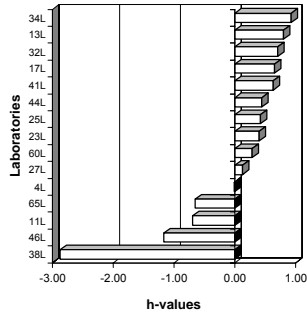
Between lab variance S2L = 3.38022  
 Reproducibility var. S2R = 3.66931  
 Reproducibility std. SR = 1.91554 --> 69.42% R = 5.3635

Remarks: 1 Lab rejected! (41L)

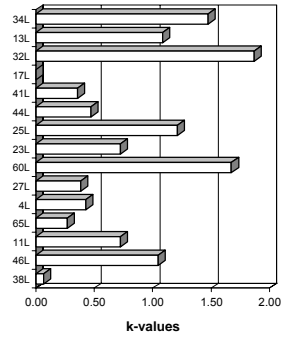


Sample: **Compost 1**  
 Element: **Benzo(a)pyrene**

**Mandel's h statistics**  
 (Compost 1 - Benzo(a)pyrene)



**Mandel's k statistics**  
 (Compost 1 - Benzo(a)pyrene)



Unit:  $\mu\text{g/kg}$

Mandel's k statistics (Compost 1 - Benzo(a)pyrene)  
 Mandel's h statistics (Compost 1 - Benzo(a)pyrene)  
 Compost 1 - Benzo(a)pyrene -- Mean PARM = 381.1 [ $\mu\text{g/kg}$ ]

General calc.parm.  
 T1= 2.00515E+04  
 T2= 7.81992E+06  
 T3= 53  
 T4= 209  
 T5= 1.1352E+05  
 n= variabel  
 p= 14  
 N-table= 4

Mandel's statistics														End Result:		
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > \text{AvST}+2\text{std}$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean		
38L	48.0000	3.464	4	II	-2.87	0.07		Fail			.38L			-333.10		
46L	232.5000	54.391	4		-1.17	1.05		Fail	232.5000	54.3906		4	3	-148.60		
11L	284.0175	37.488	4		-0.69	0.72		Fail	284.0175	37.4885		4	3	-97.08		
65L	287.7500	14.104	4		-0.66	0.27		Fail	287.7500	14.1038		4	3	-93.35		
4L	357.5000	22.174	4		-0.01	0.43			357.5000	22.1736		4	3	-23.60		
27L	372.6250	20.121	4		0.13	0.39			372.6250	20.1207		4	3	-8.47		
60L	390.0000	86.998	4		0.29	1.67	I		390.0000	86.9981		4	3	8.90		
23L	402.5000	37.749	4		0.40	0.73			402.5000	37.7492		4	3	21.40		
25L	404.2500	62.983	4		0.42	1.21			404.2500	62.9835		4	3	23.15		
44L	406.2500	24.554	4		0.44	0.47			406.2500	24.5544		4	3	25.15		
41L	427.5000	18.646	4		0.63	0.36		Fail	427.5000	18.6458		4	3	46.40		
17L	430.0000	-	1		0.66			Fail	430.0000			1		48.90		
32L	435.0000	97.125	4		0.70	1.87	I	Fail	435.0000	97.1253		4	3	53.90		
13L	446.0000	56.439	4		0.81	1.09		Fail	446.0000	56.4388		4	3	64.90		
34L	459.4750	76.493	4		0.93	1.47		Fail	459.4750	76.4928		4	3	78.38		
Tot.gem	358.891	43.766 $\mu\text{g/kg}$		1%-level:	2.32	(1.87)			14	381.0977	(38L)	14	13			
Tot.std=	108.205	29.135		5%-level:	1.86	(1.59)			1							

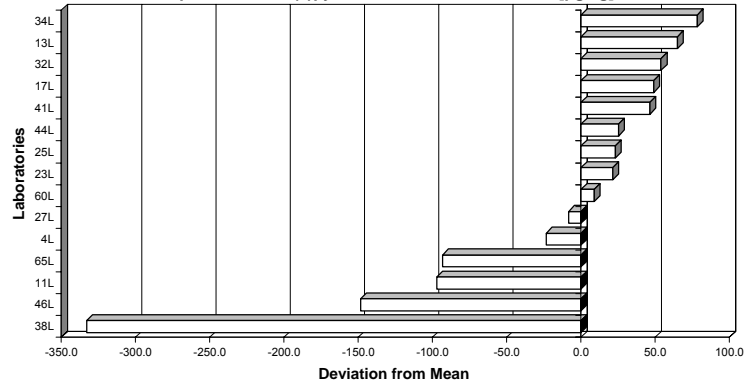
**RESULTS:** Mean = **381.09768**  $\mu\text{g/kg}$

Repeatability variance S2r = 2910.77842  
 Repeatability std. Sr = **53.95163** --> 14.16% r = 151.0646

Between lab variance S2L = 3995.75110  
 Reproducibility var. S2R = 6906.52951  
 Reproducibility std. SR = **83.10553** --> 21.81% R = 232.6955

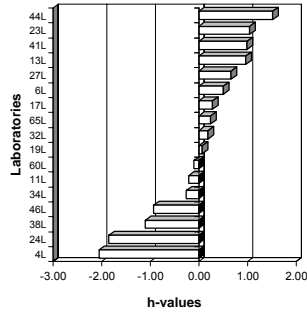
Remarks: 1 Lab rejected! (38L)

**Compost 1 - Benzo(a)pyrene -- Mean PARM = 381.1 [ $\mu\text{g/kg}$ ]**

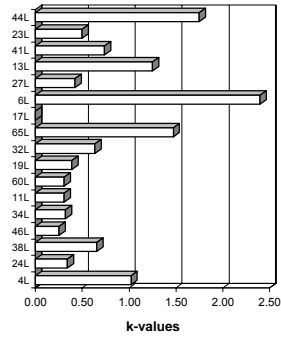


Sample: **Sludge 1**  
 Element: **Benzo(a)pyrene**

Mandel's h statistics  
 (Sludge 1 - Benzo(a)pyrene)



Mandel's k statistics  
 (Sludge 1 - Benzo(a)pyrene)



Unit: ug/kg

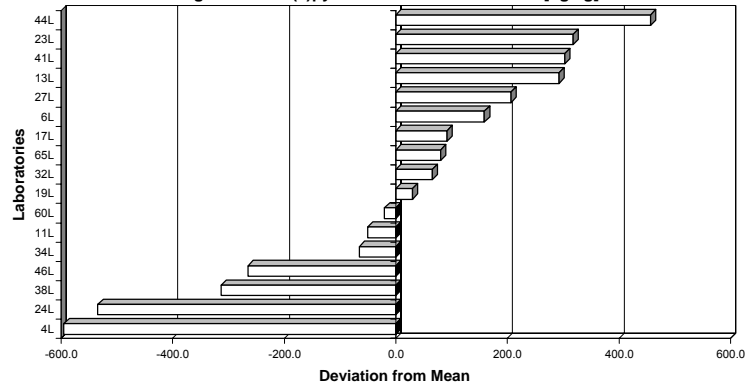
Mandel's k statistics (Sludge 1 - Benzo(a)pyrene)  
 Mandel's h statistics (Sludge 1 - Benzo(a)pyrene)  
 Sludge 1 - Benzo(a)pyrene -- Mean PARM = 820 [ug/kg]

General calc.parm.  
 T1= 4.83998E+04  
 T2= 4.52346E+07  
 T3= 58  
 T4= 222  
 T5= 1.7371E+05  
 n= variabel  
 p= 16  
 N-table= 4

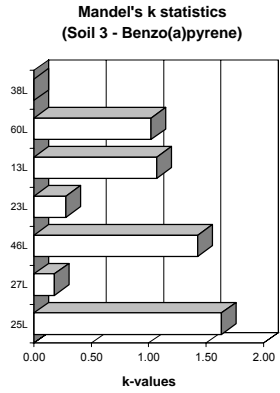
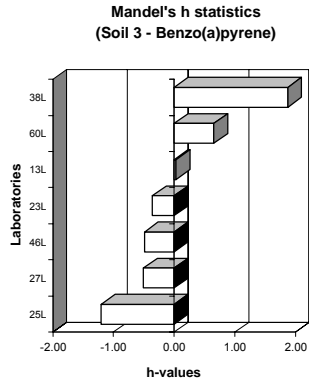
Mandel's statistics										End Result:					
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark	AvX > AvST+2std	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
4L	225.0000	77.244	4	!	-2.05	1.02		Fail		225.0000	77.2442		4	3	-594.96
24L	286.0000	26.022	2		-1.84	0.34		Fail		286.0000	26.0215		2	1	-533.96
38L	506.5000	49.487	4		-1.10	0.65		Fail		506.5000	49.4874		4	3	-313.46
46L	555.0000	19.149	4		-0.93	0.25		Fail		555.0000	19.1485		4	3	-264.96
34L	754.4500	24.245	4		-0.25	0.32				754.4500	24.2451		4	3	-65.51
11L	769.6733	23.154	3		-0.20	0.31				769.6733	23.1545		3	2	-50.29
60L	800.0000	23.094	4		-0.10	0.31				800.0000	23.0940		4	3	-19.96
19L	850.0000	29.439	4		0.07	0.39				850.0000	29.4392		4	3	30.04
32L	885.0000	47.958	4		0.19	0.63				885.0000	47.9583		4	3	65.04
65L	900.0000	111.197	4		0.24	1.47				900.0000	111.1965		4	3	80.04
17L	912.0000	-	1		0.28					912.0000	-		1		92.04
6L	979.0000	181.297	4		0.51	2.40	!!	Fail			6L				159.04
27L	1028.2500	31.920	4		0.67	0.42		Fail		1028.2500	31.9205		4	3	206.29
13L	1112.7500	94.412	4		0.96	1.25		Fail		1112.7500	94.4118		4	3	292.79
41L	1122.5000	55.603	4		1.00	0.74		Fail		1122.5000	55.6028		4	3	302.54
23L	1137.5000	37.749	4		1.05	0.50		Fail		1137.5000	37.7492		4	3	317.54
44L	1276.7500	132.041	4		1.52	1.75	!	Fail		1276.7500	132.0413		4	3	456.79
Tot.gem	829.316	60.251 ug/kg			1%-level:	2.35				16	819.9608	(6L)	16	15	
Tot.std=	294.522	47.130			5%-level:	1.87				1					

RESULTS: Mean = **819.96083** ug/kg  
 Repeatability variance S2r = 4135.85950  
 Repeatability std. Sr = **64.31065** --> 7.84% r = 180.0698  
 Between lab variance S2L = 88308.61962  
 Reproducibility var. S2R = 92444.47912  
 Reproducibility std. SR = **304.04684** --> 37.08% R = 851.3311  
 Remarks: 1 Lab rejected! (6L)

Sludge 1 - Benzo(a)pyrene -- Mean PARM = 820 [ug/kg]



Sample: **Soil 3**  
 Element: **Benzo(a)pyrene**



Unit:  $\mu\text{g}/\text{kg}$

Mandel's k statistics (Soil 3 - Benzo(a)pyrene)  
 Mandel's h statistics (Soil 3 - Benzo(a)pyrene)  
 Soil 3 - Benzo(a)pyrene -- Mean PARM = 2.46 [ $\mu\text{g}/\text{kg}$ ]

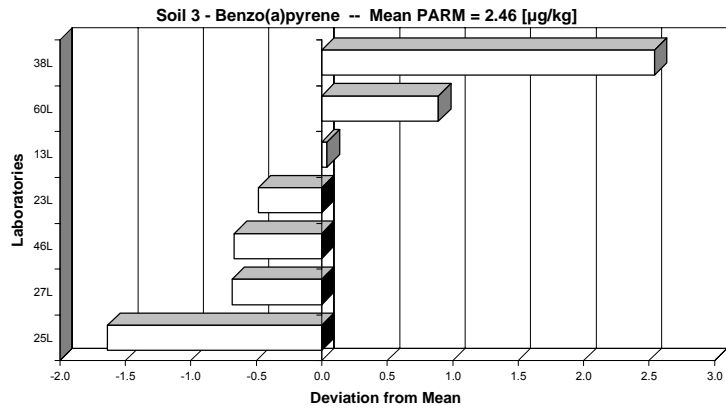
General calc.parm.  
 T1= 5.88701E+01  
 T2= 1.63670E+02  
 T3= 26  
 T4= 100  
 T5= 6.1140E+00  
 n= variabel 7  
 p= 7  
 N-table= 4

Mandel's statistics										End Result:					
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > \text{AvST}+2\text{std}$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean	
25L	0.8250	0.881	4		-1.20	1.63	!	Fail	0.8250	0.8808		4	3	-1.63	
27L	1.7750	0.096	4		-0.50	0.18			1.7750	0.0957		4	3	-0.68	
46L	1.7925	0.771	4		-0.49	1.43			1.7925	0.7706		4	3	-0.67	
23L	1.9750	0.150	4		-0.36	0.28			1.9750	0.1500		4	3	-0.48	
13L	2.5000	0.577	4		0.03	1.07			2.5000	0.5774		4	3	0.04	
60L	3.3500	0.551	4		0.66	1.02		Fail	3.3500	0.5508		4	3	0.89	
38L	5.0000		2	I	1.87			Fail	5.0000			2	1	2.54	
Tot.gem	2.460	0.432 $\mu\text{g}/\text{kg}$			1.98	(1.79)			7	2.4596	()	7	6		
Tot.stde	1.358	0.349			1.71	(1.55)									

**RESULTS:** Mean = 2.45965  $\mu\text{g}/\text{kg}$

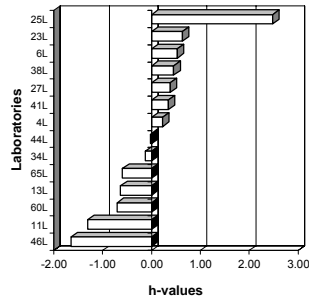
Repeatability variance S2r = 0.32179  
 Repeatability std. Sr = 0.56727 --> 23.06% r = 1.5883  
 Between lab variance S2L = 1.26391  
 Reproducibility var. S2R = 1.60571  
 Reproducibility std. SR = 1.26716 --> 51.52% R = 3.5481

Remarks: none

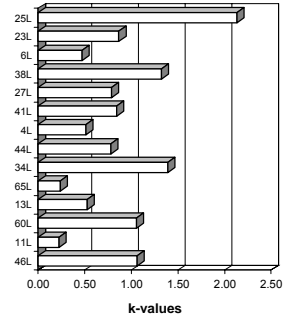


Sample: Compost 1  
 Element: Benzo(b)fluoranthene

Mandel's h statistics  
 (Compost 1 -  
 Benzo(b)fluoranthene)



Mandel's k statistics  
 (Compost 1 -  
 Benzo(b)fluoranthene)



Unit: µg/kg

Mandel's k statistics (Compost 1 - Benzo(b)fluoranthene)  
 Mandel's h statistics (Compost 1 - Benzo(b)fluoranthene)  
 Compost 1 - Benzo(b)fluoranthene -- Mean PARM = 543.5 [µg/kg]

General calc.parm.  
 T1= 2.98138E+04  
 T2= 1.73563E+07  
 T3= 55  
 T4= 217  
 T5= 1.7469E+05  
 n= variabel  
 p= 14  
 N-table= 4

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	292.5000	68.496	4		-1.65	1.06		Fail	292.5000	68.4957		4	3	-251.02
11L	344.6875	14.514	4		-1.31	0.22		Fail	344.6875	14.5135		4	3	-198.83
60L	437.0000	68.308	4		-0.70	1.06		Fail	437.0000	68.3081		4	3	-106.52
13L	447.5000	33.956	4		-0.63	0.53		Fail	447.5000	33.9559		4	3	-96.02
65L	453.2500	15.240	4		-0.59	0.24		Fail	453.2500	15.2398		4	3	-90.27
34L	524.7750	89.745	4		-0.12	1.39			524.7750	89.7449		4	3	-18.74
44L	540.2500	50.441	4		-0.02	0.78			540.2500	50.4406		4	3	-3.27
4L	577.5000	33.040	4		0.22	0.51			577.5000	33.0404		4	3	33.98
41L	595.5000	54.586	4		0.34	0.84			595.5000	54.5863		4	3	51.98
27L	601.2250	50.929	4		0.38	0.79			601.2250	50.9295		4	3	57.71
38L	612.5000	85.391	4		0.45	1.32		Fail	612.5000	85.3913		4	3	68.98
6L	623.3333	30.551	3		0.53	0.47		Fail	623.3333	30.5505		3	2	79.81
23L	640.0000	55.976	4		0.63	0.87		Fail	640.0000	55.9762		4	3	95.48
25L	919.2500	137.713	4	II	2.47	2.13	II	Fail	919.2500	137.7132		4	3	375.73
Tot.gem	543.519	56.349 µg/kg			2.30	(1.87)			14	543.5193	()	14	13	
Tot.std=	152.017	32.919			1.85	(1.59)								

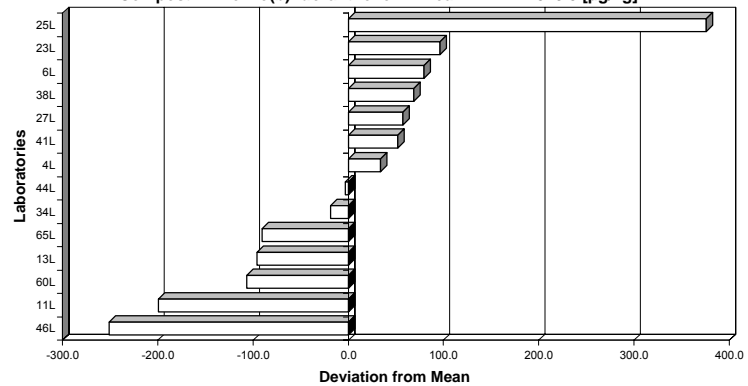
RESULTS: Mean = 543.51935 µg/kg

Repeatability variance S2r = 4260.67554  
 Repeatability std. Sr = 65.27385 --> 12.01% r = 182.7668

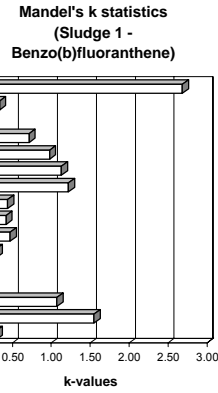
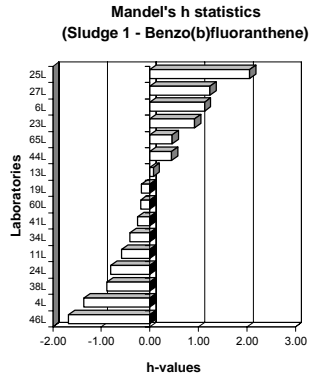
Between lab variance S2L = 22325.14522  
 Reproducibility var. S2R = 26585.82076  
 Reproducibility std. SR = 163.05159 --> 30.00% R = 456.5444

Remarks: none

Compost 1 - Benzo(b)fluoranthene -- Mean PARM = 543.5 [µg/kg]



Sample: **Sludge 1**  
 Element: **Benzo(b)fluoranthene**



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Benzo(b)fluoranthene)  
 Mandel's h statistics (Sludge 1 - Benzo(b)fluoranthene)  
 Sludge 1 - Benzo(b)fluoranthene -- Mean PARM = 1274 [ug/kg]

General calc.parm.  
 T1= 7.35020E+04  
 T2= 1.05296E+08  
 T3= 57  
 T4= 221  
 T5= 5.2766E+05  
 n= variabel  
 p= 15  
 N-table= 4

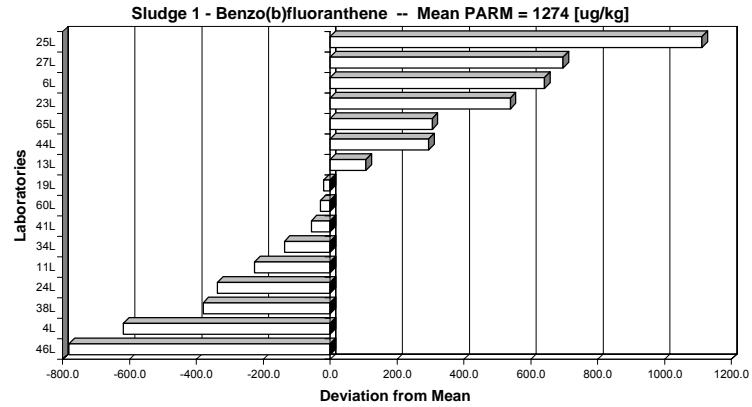
Mandel's statistics										End Result:					
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark	AvX > AvST+2std	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	492.5000	41.130	4		-1.68	0.29		Fail		492.5000	41.1299		4	3	-781.24
4L	655.0000	220.076	4		-1.36	1.55		Fail		655.0000	220.0757		4	3	-618.74
38L	894.0000	152.464	4		-0.89	1.08		Fail		894.0000	152.4642		4	3	-379.74
24L	937.0000	28.426	2		-0.80	0.20		Fail		937.0000	28.4257		2	1	-336.74
11L	1048.6400	33.879	3		-0.58	0.24		Fail		1048.6400	33.8788		3	2	-225.10
34L	1136.7750	41.647	4		-0.41	0.29		Fail		1136.7750	41.6471		4	3	-136.97
41L	1217.5000	67.020	4		-0.25	0.47				1217.5000	67.0199		4	3	-56.24
60L	1245.2500	59.281	4		-0.19	0.42				1245.2500	59.2811		4	3	-28.49
19L	1255.0000	61.914	4		-0.17	0.44				1255.0000	61.9139		4	3	-18.74
13L	1380.2500	173.142	4		0.07	1.22				1380.2500	173.1423		4	3	106.51
44L	1568.0000	159.894	4		0.44	1.13		Fail		1568.0000	159.8937		4	3	294.26
65L	1579.0000	138.706	4		0.46	0.98		Fail		1579.0000	138.7059		4	3	305.26
23L	1812.5000	101.448	4		0.93	0.72		Fail		1812.5000	101.4479		4	3	536.76
6L	1915.0000	23.805	4		1.13	0.17		Fail		1915.0000	23.8048		4	3	641.26
27L	1969.7500	47.591	4		1.24	0.34		Fail		1969.7500	47.5911		4	3	696.01
25L	2385.2500	380.602	4	I	2.05	2.68	II	Fail		-	-	,25L	-	-	1111.51
Tot.gem	1343.213	108.189 ug/kg		1%-level:	2.33	(1.88)				15	1273.7443	(25L)	15	14	
Tot.std	507.266	94.653		5%-level:	1.86	(1.59)				1					

**RESULTS:** Mean = 1273.74433 ug/kg

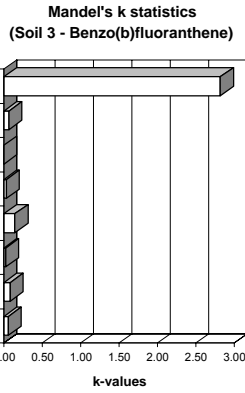
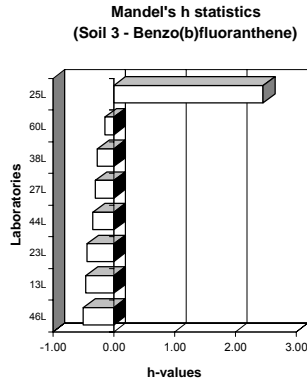
Repeatability variance S2r = 12563.24441  
 Repeatability std. Sr = 112.08588 --> 8.80% r = 313.8405

Between lab variance S2L = 194618.55887  
 Reproducibility var. S2R = 207181.80328  
 Reproducibility std. SR = 455.17228 --> 35.73% R = 1274.4824

Remarks: 1 Lab rejected! (25L)



Sample: **Soil 3**  
 Element: **Benzo(b)fluoranthene**



Unit:  $\mu\text{g}/\text{kg}$

Mandel's k statistics (Soil 3 - Benzo(b)fluoranthene)  
 Mandel's h statistics (Soil 3 - Benzo(b)fluoranthene)  
 Soil 3 - Benzo(b)fluoranthene -- Mean PARM = 3.83 [ $\mu\text{g}/\text{kg}$ ]

General calc.parm.  
 T1= 9.48039E+01  
 T2= 4.32761E+02  
 T3= 25  
 T4= 93  
 T5= 4.9013E+00  
 n= variabel 7  
 p= 4  
 N-table= 4

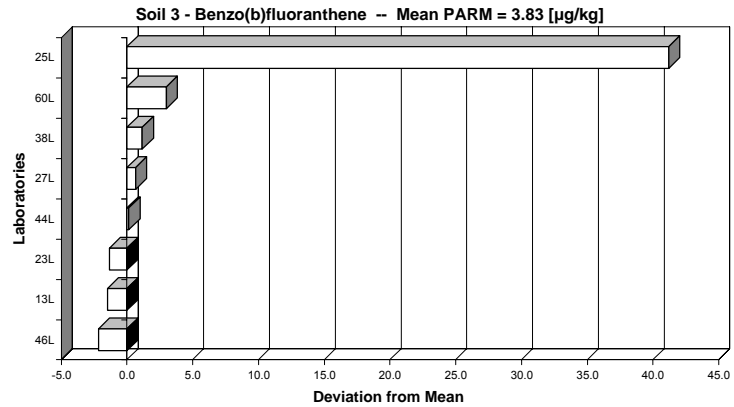
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > \text{AvST}+2\text{std}$	$\text{AvX} < \text{AvST}-2\text{std}$	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	1.6510	0.400	4		-0.50	0.06			1.6510	0.3998		4	3	-2.18
13L	2.3333	0.577	3		-0.45	0.09			2.3333	0.5774		3	2	-1.49
23L	2.5000	0.183	4		-0.44	0.03			2.5000	0.1826		4	3	-1.33
44L	3.9750	0.991	4		-0.34	0.15			3.9750	0.9912		4	3	0.15
27L	4.5000	0.216	4		-0.31	0.03			4.5000	0.2160		4	3	0.67
38L	5.0000		2		-0.27				5.0000			2	1	1.17
60L	6.8250	0.435	4		-0.15	0.06			6.8250	0.4349		4	3	3.00
25L	45.0000	19.149	4	II	2.46	2.82	II	Fail	-	-	25L	-	-	41.17
Tot.gem	8.973	2.744 $\mu\text{g}/\text{kg}$		1%-level:	2.06	(1.81)			7	3.8263		7	6	
Tot.std=	14.653	6.635		5%-level:	1.75	(1.56)			1					

RESULTS: Mean = 3.82633  $\mu\text{g}/\text{kg}$

Repeatability variance S2r = 0.27229  
 Repeatability std. Sr = 0.52182 --> 13.64% r = 1.4611

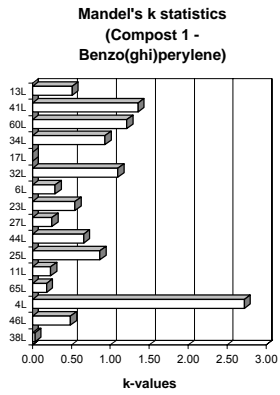
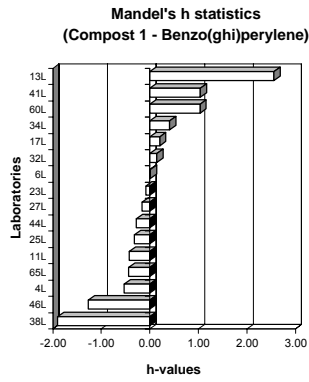
Between lab variance S2L = 3.36542  
 Reproducibility var. S2R = 3.63771  
 Reproducibility std. SR = 1.90728 --> 49.85% R = 5.3404

Remarks: 1 Lab rejected! (25L)





Sample: Compost 1  
 Element: Benzo(ghi)perylene



Unit: µg/kg

Mandel's k statistics (Compost 1 - Benzo(ghi)perylene)  
 Mandel's h statistics (Compost 1 - Benzo(ghi)perylene)  
 Compost 1 - Benzo(ghi)perylene -- Mean PARM = 313.6 [µg/kg]

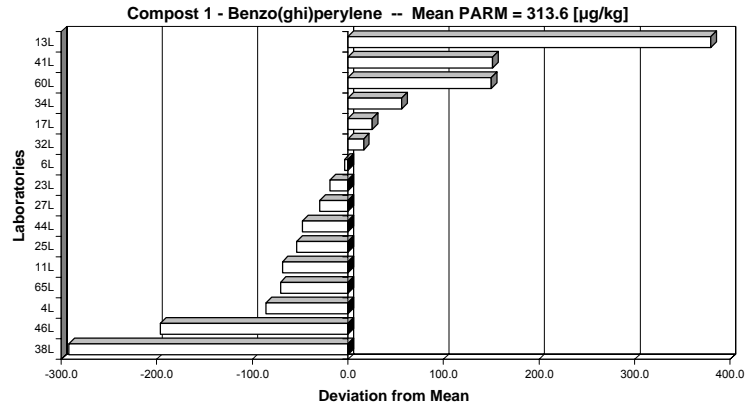
General calc.parm.  
 T1= 1.77746E+04  
 T2= 6.88756E+06  
 T3= 56  
 T4= 218  
 T5= 5.3006E+04  
 n= variabel  
 p= 15  
 N-table= 4

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
38L	21.6667	1.528	3	I	-1.90	0.03		Fail	21.6667	1.5275		3	2	-291.89
46L	117.5000	23.629	4		-1.27	0.49		Fail	117.5000	23.6291		4	3	-196.05
4L	228.0000	131.261	4		-0.53	2.72	II	Fail			.4L			-85.55
65L	242.8950	8.674	4		-0.43	0.18		Fail	242.8950	8.6738		4	3	-70.66
11L	245.0050	11.330	4		-0.42	0.23			245.0050	11.3300		4	3	-68.55
25L	260.0000	41.952	4		-0.32	0.87			260.0000	41.9524		4	3	-53.55
44L	266.0000	31.675	4		-0.28	0.66			266.0000	31.6754		4	3	-47.55
27L	284.1750	11.966	4		-0.16	0.25			284.1750	11.9662		4	3	-29.38
23L	295.0000	26.458	4		-0.09	0.55			295.0000	26.4575		4	3	-18.55
6L	310.0000	14.142	4		0.01	0.29			310.0000	14.1421		4	3	-3.55
32L	330.0000	52.915	4		0.14	1.10			330.0000	52.9150		4	3	16.45
17L	339.0000	-	1		0.20				339.0000	-		1		25.45
34L	370.0750	44.871	4		0.41	0.93			370.0750	44.8715		4	3	56.52
60L	463.7500	58.346	4		1.03	1.21		Fail	463.7500	58.3460		4	3	150.20
41L	465.0000	65.406	4		1.04	1.36		Fail	465.0000	65.4064		4	3	151.45
13L	693.2500	24.554	4	II	2.56	0.51		Fail	693.2500	24.5544		4	3	379.70
Tot.gem	308.207	36.581 µg/kg			1%-level:	2.33 (1.87)			15	313.5544	(4L)	15	14	
Tot.std	150.624	32.543			5%-level:	1.86 (1.59)			1					

RESULTS: Mean = 313.55444 µg/kg

Repeatability variance S2r = 1292.82661  
 Repeatability std. Sr = 35.95590 --> 11.47% r = 100.6765  
 Between lab variance S2L = 23561.86057  
 Reproducibility var. S2R = 24854.68718  
 Reproducibility std. SR = 157.65369 --> 50.28% R = 441.4303

Remarks: 1 Lab rejected! (4L)

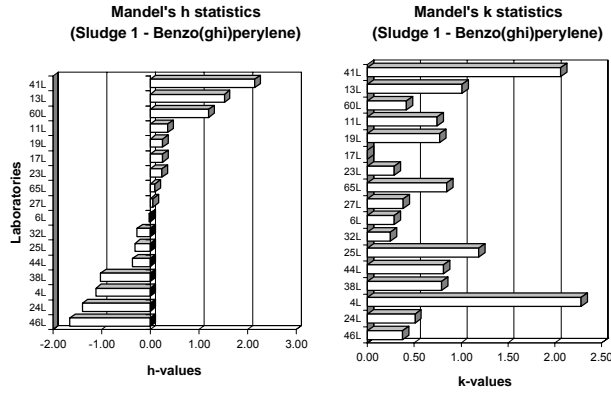


Sample: **Sludge 1**  
 Element: **Benzo(ghi)perylene**

Unit: ug/kg

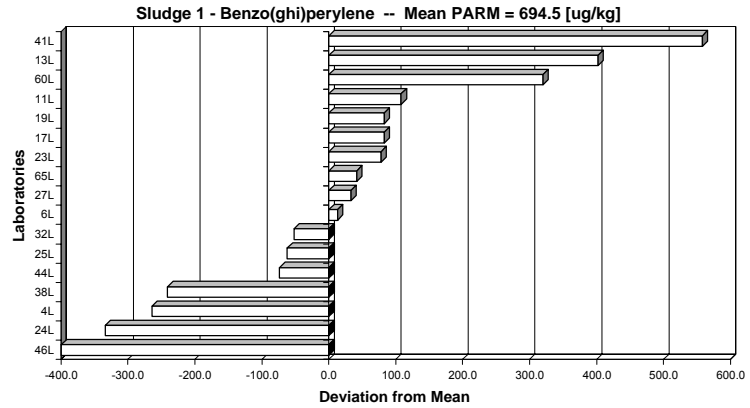
Mandel's k statistics (Sludge 1 - Benzo(ghi)perylene)  
 Mandel's h statistics (Sludge 1 - Benzo(ghi)perylene)  
 Sludge 1 - Benzo(ghi)perylene -- Mean PARM = 694.5 [ug/kg]

General calc.parm.  
 T1= 3.78134E+04  
 T2= 2.87786E+07  
 T3= 54  
 T4= 206  
 T5= 1.0861E+05  
 n= variabel  
 p= 15  
 N-table= 4



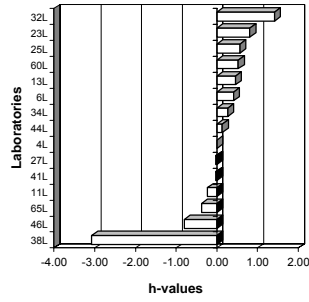
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	295.0000	28.868	4		-1.65	0.38		Fail	295.0000	28.8675		4	3	-399.47
24L	360.5000	38.891	2		-1.39	0.51		Fail	360.5000	38.8909		2	1	-333.97
4L	430.0000	174.547	4		-1.12	2.28	!!	Fail			.4L			-264.47
38L	453.7500	60.736	4		-1.02	0.79		Fail	453.7500	60.7365		4	3	-240.72
44L	621.0000	62.059	4		-0.36	0.81			621.0000	62.0591		4	3	-73.47
25L	632.5000	90.912	4		-0.31	1.19			632.5000	90.9120		4	3	-61.97
32L	642.5000	18.930	4		-0.27	0.25			642.5000	18.9297		4	3	-51.97
6L	707.5000	22.174	4		-0.02	0.29			707.5000	22.1736		4	3	13.03
27L	727.7500	29.170	4		0.06	0.38			727.7500	29.1705		4	3	33.28
65L	736.3589	64.947	4		0.10	0.85			736.3589	64.9473		4	3	41.89
23L	772.5000	22.174	4		0.24	0.29			772.5000	22.1736		4	3	78.03
17L	777.0000	-	1		0.26				777.0000	-		1		82.53
19L	777.5000	59.090	4		0.26	0.77			777.5000	59.0903		4	3	83.03
11L	802.6633	56.788	3		0.36	0.74			802.6633	56.7876		3	2	108.20
60L	1014.2500	31.920	4		1.20	0.42		Fail	1014.2500	31.9205		4	3	319.78
13L	1096.2500	77.401	4		1.53	1.01		Fail	1096.2500	77.4010		4	3	401.78
41L	1252.5000	157.560	4	I	2.15	2.06	!!	Fail			.41L			558.03
Tot.gem	711.737	62.260 ug/kg		1%-level:	2.35	(1.88)			15	694.4682		15	14	
Tot.std=	251.929	45.868		5%-level:	1.87	(1.59)			2		(4L,41L)			

**RESULTS:** Mean = **694.46815** ug/kg  
 Repeatability variance S2r = 2784.99091  
 Repeatability std. Sr = **52.77301** --> 7.60% r = 147.7644  
 Between lab variance S2L = 45050.29625  
 Reproducibility var. S2R = 47835.28716  
 Reproducibility std. SR = **218.71280** --> 31.49% R = 612.3958  
 Remarks: 2 Labs rejected! (4L,41L)

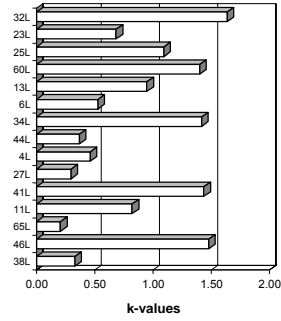


Sample: Compost 1  
 Element: Benzo(k)fluoranthene

Mandel's h statistics  
 (Compost 1 -  
 Benzo(k)fluoranthene)



Mandel's k statistics  
 (Compost 1 -  
 Benzo(k)fluoranthene)



Unit: µg/kg

Mandel's k statistics (Compost 1 - Benzo(k)fluoranthene)  
 Mandel's h statistics (Compost 1 - Benzo(k)fluoranthene)  
 Compost 1 - Benzo(k)fluoranthene -- Mean PARM = 236.1 [µg/kg]

General calc.parm.  
 T1= 1.32194E+04  
 T2= 3.18005E+06  
 T3= 56  
 T4= 224  
 T5= 4.6775E+04  
 n= variabel  
 p= 14  
 N-table= 4

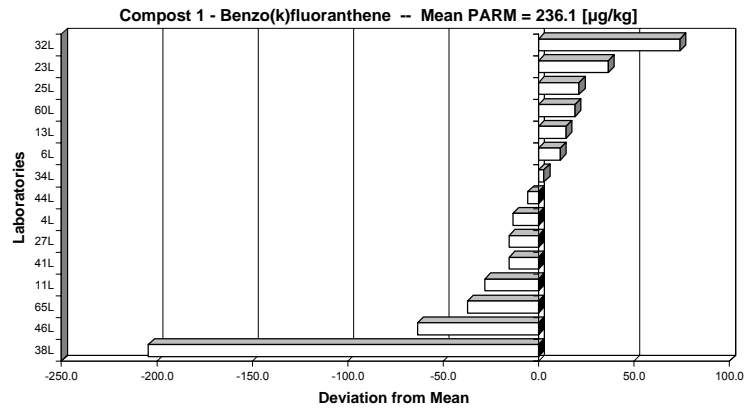
LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics		k-mark	AvX > AvST+2std	AvX < AvST-2std	End Result:					
					h	k				PARM	Stdev	Rej.labs	N	N-1	dev_mean
38L	31.6667	10.693	3	II	-3.08	0.33				172.5161	47.8613	.38L	4	3	-204.39
46L	172.5161	47.861	4		-0.80	1.48		Fail		198.7500	6.7020		4	3	-63.54
65L	198.7500	6.702	4		-0.38	0.21		Fail		207.8825	26.5637		4	3	-37.31
11L	207.8825	26.564	4		-0.23	0.82				220.5000	46.4579		4	3	-28.18
41L	220.5000	46.458	4		-0.03	1.44				220.6500	9.6421		4	3	-15.56
27L	220.6500	9.642	4		-0.03	0.30				222.5000	15.0000		4	3	-15.41
4L	222.5000	15.000	4		0.00	0.46				230.5000	11.9304		4	3	-13.56
44L	230.5000	11.930	4		0.13	0.37				238.8000	45.8097		4	3	-5.56
34L	238.8000	45.810	4		0.26	1.42				247.5000	17.0783		4	3	2.74
6L	247.5000	17.078	4		0.40	0.53				250.5000	30.6649		4	3	11.44
13L	250.5000	30.665	4		0.45	0.95				255.0000	45.3652		4	3	14.44
60L	255.0000	45.365	4		0.53	1.40		Fail		257.2500	35.3777		4	3	18.94
25L	257.2500	35.378	4		0.56	1.09		Fail		272.5000	22.1736		4	3	21.19
23L	272.5000	22.174	4		0.81	0.69		Fail		310.0000	52.9150		4	3	36.44
32L	310.0000	52.915	4		1.41	1.64	I	Fail					4	3	73.94
Tot.gem	222.434	28.282 µg/kg		1%-level:	2.32	(1.87)			14	236.0606	(38L)		14	13	
Tot.std=	62.025	16.274		5%-level:	1.86	(1.59)			1						

RESULTS: Mean = 236.0601 µg/kg

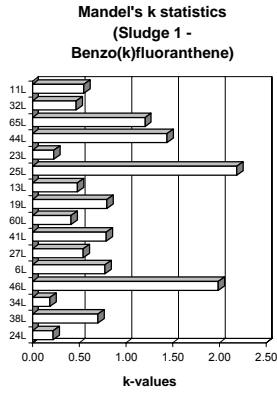
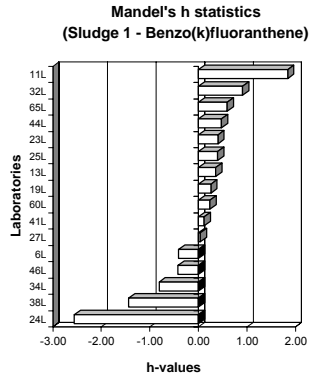
Repeatability variance S2r = 1113.69033  
 Repeatability std. Sr = 33.37200 --> 14.14% r = 93.4416

Between lab variance S2L = 865.25722  
 Reproducibility var. S2R = 1978.94755  
 Reproducibility std. SR = 44.48536 --> 18.84% R = 124.5590

Remarks: 1 Lab rejected! (38L)



Sample: **Sludge 1**  
 Element: **Benzo(k)fluoranthene**



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Benzo(k)fluoranthene)  
 Mandel's h statistics (Sludge 1 - Benzo(k)fluoranthene)  
 Sludge 1 - Benzo(k)fluoranthene -- Mean PARM = 590.2 [ug/kg]

General calc.parm.  
 T1= 3.65685E+04  
 T2= 2.32086E+07  
 T3= 61  
 T4= 237  
 T5= 1.2155E+05  
 n= variabel  
 p= 16  
 N-table= 4

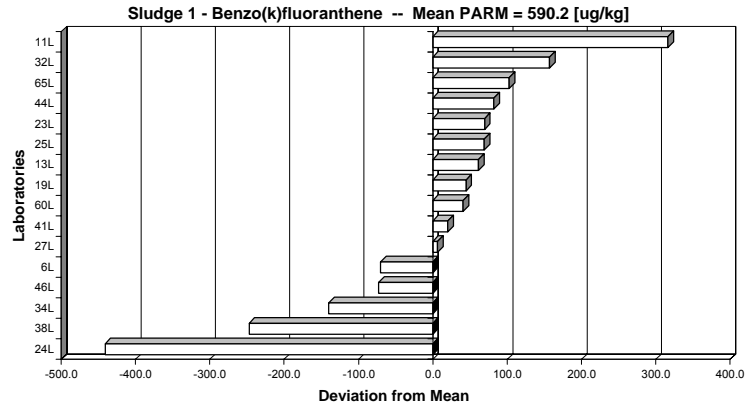
Mandel's statistics										End Result:					
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark	AvX > AvST+2std	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
24L	149.2000	11.172	2	II	-2.56	0.22		Fail		149.2000	11.1723		2	1	-441.02
38L	343.0000	35.355	4		-1.43	0.70		Fail		343.0000	35.3553		4	3	-247.22
34L	450.3750	9.624	4		-0.81	0.19		Fail		450.3750	9.6244		4	3	-139.84
46L	517.5000	100.457	4		-0.42	1.99	II	Fail		517.5000	100.4573		4	3	-72.72
6L	520.0000	39.158	4		-0.41	0.77		Fail		520.0000	39.1578		4	3	-70.22
27L	596.5000	27.477	4		0.04	0.54			Fail	596.5000	27.4773		4	3	6.28
41L	610.2500	40.095	4		0.12	0.79				610.2500	40.0947		4	3	20.03
60L	631.2500	20.998	4		0.24	0.42				631.2500	20.9980		4	3	41.03
19L	635.0000	40.415	4		0.26	0.80				635.0000	40.4145		4	3	44.78
13L	651.5000	24.283	4		0.36	0.48		Fail		651.5000	24.2831		4	3	61.28
25L	659.2500	110.678	4		0.40	2.19	II	Fail		659.2500	110.6778		4	3	69.03
23L	660.0000	11.547	4		0.41	0.23		Fail		660.0000	11.5470		4	3	69.78
44L	672.2500	72.871	4		0.48	1.44		Fail		672.2500	72.8715		4	3	82.03
65L	693.0000	60.943	4		0.60	1.21		Fail		693.0000	60.9426		4	3	102.78
32L	747.5000	23.629	4		0.91	0.47		Fail		747.5000	23.6291		4	3	157.28
11L	906.8733	27.786	3		1.84	0.55		Fail		906.8733	27.7865		3	2	316.66
Tot.gem	590.216	41.031 ug/kg		1%-level:	2.33	(1.88)				16	590.2155	()	16	15	
Tot.std=	172.281	30.464		5%-level:	1.86	(1.59)									

**RESULTS:** Mean = **590.21552** ug/kg

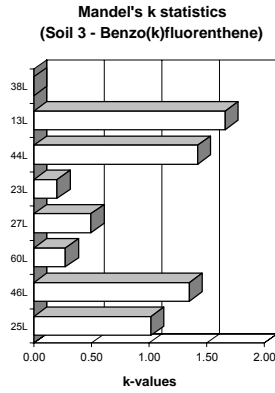
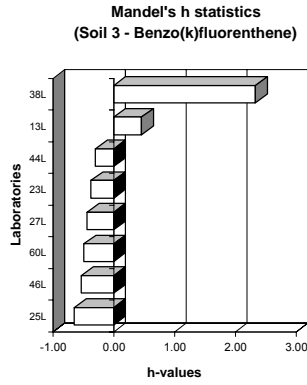
Repeatability variance S2r = 2701.06403  
 Repeatability std. Sr = **51.97176** --> 8.81% r = 145.5209

Between lab variance S2L = 21812.61890  
 Reproducibility var. S2R = 24513.68293  
 Reproducibility std. SR = **156.56846** --> 26.53% R = 438.3917

Remarks: none



Sample: **Soil 3**  
 Element: **Benzo(k)fluorethene**



Unit:  $\mu\text{g}/\text{kg}$

Mandel's k statistics (Soil 3 - Benzo(k)fluorethene)  
 Mandel's h statistics (Soil 3 - Benzo(k)fluorethene)  
 Soil 3 - Benzo(k)fluorethene -- Mean PARM = 1.02 [ $\mu\text{g}/\text{kg}$ ]

General calc.parm.  
 T1= 1.80627E+01  
 T2= 1.84614E+01  
 T3= 18  
 T4= 60  
 T5= 1.1545E+00  
 n= variabel  
 ps  
 N-table= 3

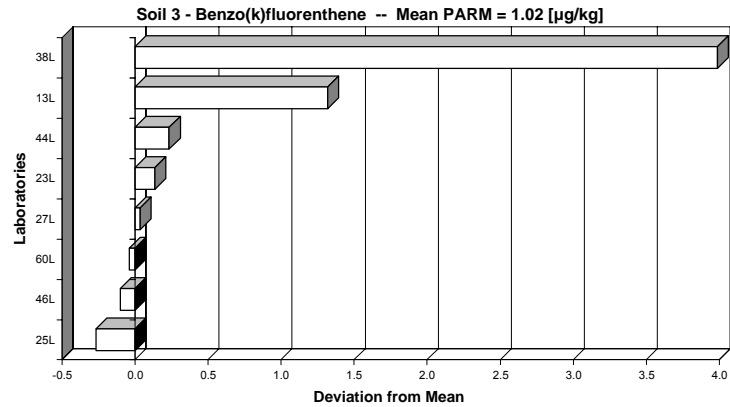
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{x} > \text{AvST}+2\text{std}$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
25L	0.7500	0.354	2		-0.65	1.02		Fail	0.7500	0.3536		2	1	-0.27
46L	0.9157	0.470	4		-0.53	1.35		Fail	0.9157	0.4698		4	3	-0.10
60L	0.9750	0.096	4		-0.49	0.28		Fail	0.9750	0.0957		4	3	-0.04
27L	1.0500	0.173	4		-0.44	0.50		Fail	1.0500	0.1732		4	3	0.03
23L	1.1500	0.071	2		-0.37	0.20		Fail	1.1500	0.0707		2	1	0.13
44L	1.2500	0.495	2		-0.30	1.42			1.2500	0.4950		2	1	0.23
13L	2.3333	0.577	3		0.46	1.66		Fail	-	-	.13L	-	-	1.32
38L	5.0000		2	!!	2.33			Fail	-	-	.38L	-	-	3.98
Tot.gem	1.678	0.279 $\mu\text{g}/\text{kg}$		1%-level:	2.06	(1.97)			6	1.0151	(13L,38L)	6	5	
Tot.std=	1.427	0.222		5%-level:	1.75	(1.67)			2					

RESULTS: Mean = 1.01511  $\mu\text{g}/\text{kg}$

Repeatability variance S2r = 0.09621  
 Repeatability std. Sr = 0.31018 --> 30.56% r = 0.8685

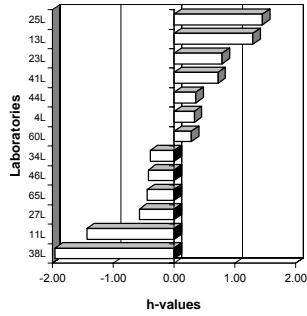
Between lab variance S2L = -0.00991  
 Reproducibility var. S2R = 0.09621  
 Reproducibility std. SR = 0.31018 --> 30.56% R = 0.8685

Remarks: 2 Labs rejected! (13L,38L)

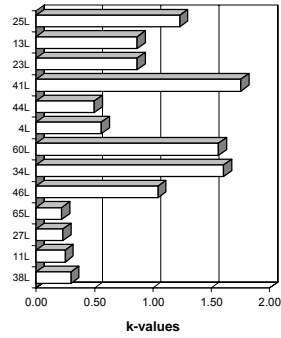


Sample: **Compost 1**  
 Element: **Chryzene**

Mandel's h statistics  
(Compost 1 - Chryzene)



Mandel's k statistics  
(Compost 1 - Chryzene)



Unit: µg/kg

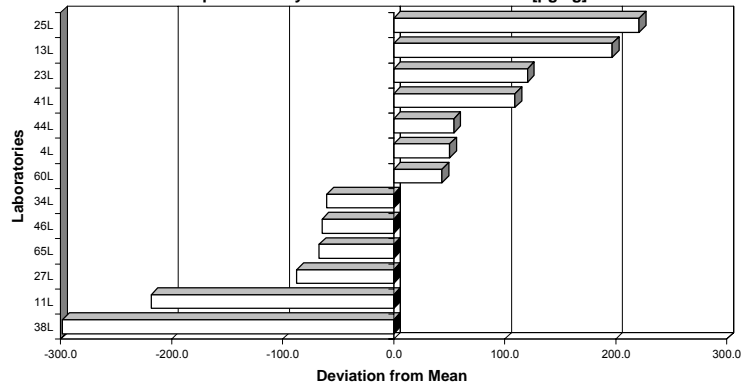
Mandel's k statistics (Compost 1 - Chryzene)  
 Mandel's h statistics (Compost 1 - Chryzene)  
 Compost 1 - Chryzene -- Mean PARM = 424.6 [µg/kg]

General calc.parm.  
 T1= 2.20781E+04  
 T2= 1.04856E+07  
 T3= 52  
 T4= 208  
 T5= 8.8160E+04  
 n= variabel  
 p= 13  
 N-table= 4

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
38L	126.5000	14.107	4	!	-1.96	0.30		Fail	126.5000	14.1067		4	3	-298.08
11L	206.1525	11.791	4		-1.44	0.25		Fail	206.1525	11.7906		4	3	-218.43
27L	337.3000	10.840	4		-0.57	0.23		Fail	337.3000	10.8400		4	3	-87.28
65L	357.5000	10.408	4		-0.44	0.22		Fail	357.5000	10.4083		4	3	-67.08
46L	360.0000	49.666	4		-0.42	1.04		Fail	360.0000	49.6655		4	3	-64.58
34L	364.3250	76.311	4		-0.40	1.61	!	Fail	364.3250	76.3113		4	3	-60.25
60L	468.0000	74.238	4		0.29	1.56			468.0000	74.2384		4	3	43.42
4L	475.0000	26.458	4		0.33	0.56			475.0000	26.4575		4	3	50.42
44L	478.7500	23.684	4		0.36	0.50		Fail	478.7500	23.6837		4	3	54.17
41L	534.0000	83.359	4		0.72	1.75	!	Fail	534.0000	83.3587		4	3	109.42
23L	545.0000	41.231	4		0.79	0.87		Fail	545.0000	41.2311		4	3	120.42
13L	621.2500	41.080	4		1.29	0.86		Fail	621.2500	41.0802		4	3	196.67
25L	645.7500	58.517	4		1.45	1.23		Fail	645.7500	58.5171		4	3	221.17
Tot.gem	424.579	40.130 µg/kg			2.27	(1.86)			13	424.5790	()	13	12	
Tot.std=	152.182	26.538			1.84	(1.58)								

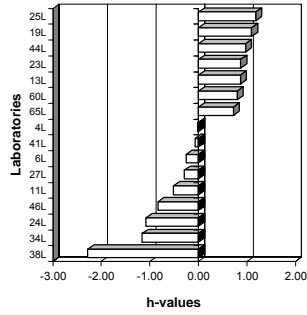
RESULTS: Mean = 424.57904 µg/kg  
 Repeatability variance S2r = 2260.51411  
 Repeatability std. Sr = 47.54486 --> 11.20% r = 133.1256  
 Between lab variance S2L = 22594.19295  
 Reproducibility var. S2R = 24854.70705  
 Reproducibility std. SR = 157.65376 --> 37.13% R = 441.4305  
 Remarks: none

Compost 1 - Chryzene -- Mean PARM = 424.6 [µg/kg]

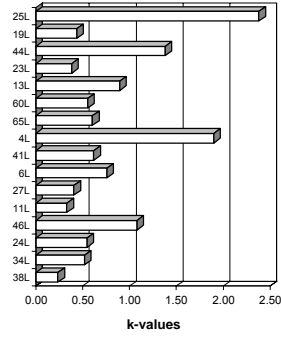


Sample: **Sludge 1**  
 Element: **Chryzene**

Mandel's h statistics  
 (Sludge 1 - Chryzene)



Mandel's k statistics  
 (Sludge 1 - Chryzene)



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Chryzene)  
 Mandel's h statistics (Sludge 1 - Chryzene)  
 Sludge 1 - Chryzene -- Mean PARM = 1077 [ug/kg]

General calc.parm.  
 T1= 5.78379E+04  
 T2= 6.81906E+07  
 T3= 53  
 T4= 205  
 T5= 1.8023E+05  
 n= variabel  
 p= 14  
 N-table= 4

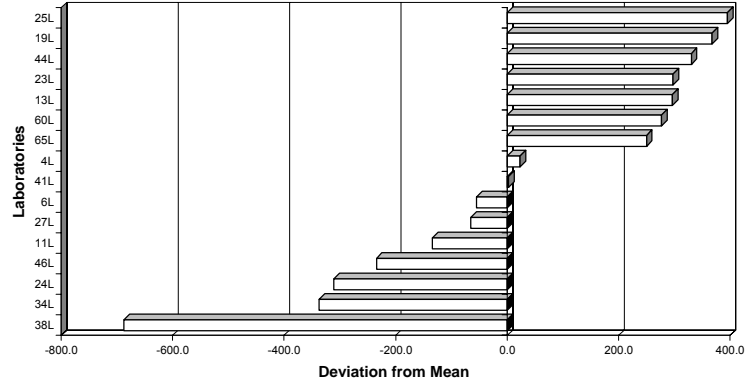
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark	AvX > AvST+2std	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
38L	389.5000	22.531	4	!	-2.28	0.23		Fail		389.5000	22.5315		4	3	-687.51
34L	740.2250	49.929	4		-1.16	0.52		Fail		740.2250	49.9286		4	3	-336.79
24L	765.9000	52.467	2		-1.08	0.55		Fail		765.9000	52.4673		2	1	-311.11
46L	842.5000	103.722	4		-0.83	1.08		Fail		842.5000	103.7224		4	3	-234.51
11L	943.0633	31.844	3		-0.51	0.33		Fail		943.0633	31.8444		3	2	-133.95
27L	1012.0000	39.013	4		-0.29	0.41				1012.0000	39.0128		4	3	-65.01
6L	1022.5000	72.744	4		-0.26	0.76				1022.5000	72.7438		4	3	-54.51
41L	1080.0000	59.442	4		-0.07	0.62				1080.0000	59.4418		4	3	2.99
4L	1100.0000	182.574	4		-0.01	1.90	!!					.4L			22.99
65L	1327.2500	58.088	4		0.72	0.60		Fail		1327.2500	58.0883		4	3	250.24
60L	1353.7500	53.056	4		0.80	0.55		Fail		1353.7500	53.0558		4	3	276.74
13L	1374.0000	86.035	4		0.87	0.89		Fail		1374.0000	86.0349		4	3	296.99
23L	1375.0000	36.968	4		0.87	0.38		Fail		1375.0000	36.9685		4	3	297.99
44L	1407.5000	132.867	4		0.97	1.38		Fail		1407.5000	132.8671		4	3	330.49
19L	1445.0000	42.032	4		1.09	0.44		Fail		1445.0000	42.0317		4	3	367.99
25L	1472.7500	229.067	4		1.18	2.38	!!	Fail				.25L			395.74
Tot.gem	1103.184	78.274 ug/kg		1%-level:	2.33	(1.88)			14	1077.0135	(4L,25L)		14	13	
Tot.std	313.055	57.751		5%-level:	1.86	(1.59)			2						

RESULTS: Mean = 1077.01345 ug/kg

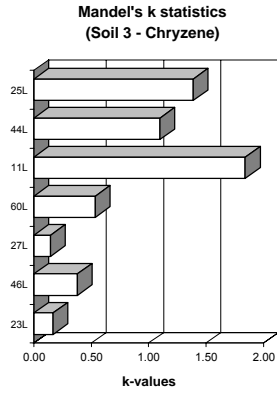
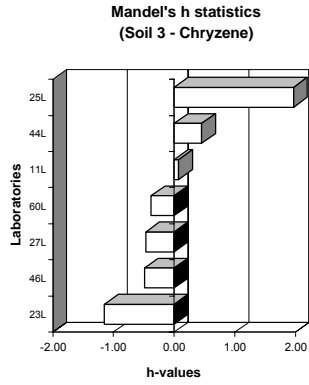
Repeatability variance S2r = 4621.36059  
 Repeatability std. Sr = 67.98059 --> 6.31% r = 190.3457  
 Between lab variance S2L = 102033.15808  
 Reproducibility var. S2R = 106654.51867  
 Reproducibility std. SR = 326.58003 --> 30.32% R = 914.4241

Remarks: 2 Labs rejected! (4L,25L)

Sludge 1 - Chryzene -- Mean PARM = 1077 [ug/kg]



Sample: **Soil 3**  
 Element: **Chryzene**



Unit:  $\mu\text{g}/\text{kg}$

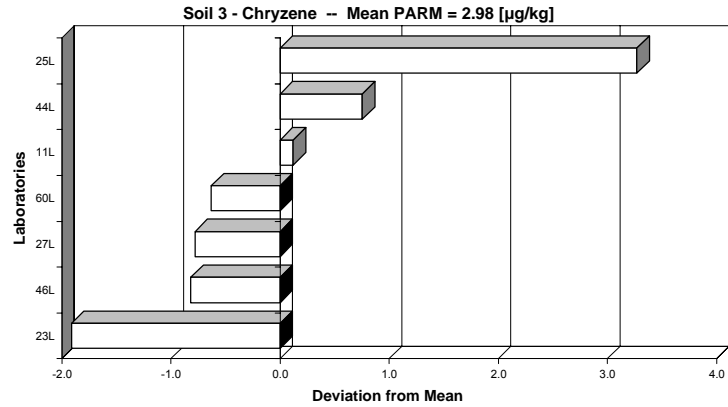
Mandel's k statistics (Soil 3 - Chryzene)  
 Mandel's h statistics (Soil 3 - Chryzene)  
 Soil 3 - Chryzene -- Mean PARM = 2.98 [ $\mu\text{g}/\text{kg}$ ]

General calc.parm.  
 T1= 7.02414E+01  
 T2= 2.75975E+02  
 T3= 23  
 T4= 79  
 T5= 6.1760E+00  
 n= variabel 7  
 p= 7  
 N-table= 3

LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics		k-mark $\sqrt{X} > \text{AvST}+2\text{std}$	AvX < AvST-2std	End Result:		Rej.labs	N	N-1	dev_mean
					h	k			PARM	Stdev				
23L	1.0667	0.115	3	-1.15	0.17				1.0667	0.1155		3	2	-1.91
46L	2.1604	0.260	4	-0.49	0.38		Fail		2.1604	0.2599		4	3	-0.82
27L	2.2000	0.100	3	-0.47	0.14				2.2000	0.1000		3	2	-0.78
60L	2.3500	0.370	4	-0.38	0.54				2.3500	0.3697		4	3	-0.63
11L	3.1000	1.273	2	0.07	1.84				3.1000	1.2728		2	1	0.12
44L	3.7333	0.757	3	0.45	1.10				3.7333	0.7572		3	2	0.75
25L	6.2500	0.957	4	1.97	1.39		Fail		6.2500	0.9574		4	3	-3.27
Tot.gem	2.980	0.547 $\mu\text{g}/\text{kg}$						7	2.9801	()		7	6	
Tot.stdev	1.664	0.454		1%-level: 1.98 (1.94) 5%-level: 1.71 (1.66)										

**RESULTS:** Mean = 2.98005  $\mu\text{g}/\text{kg}$

Repeatability variance S2r = 0.38600  
 Repeatability std. Sr = 0.62129 --> 20.85% r = 1.7396  
 Between lab variance S2L = 3.02290  
 Reproducibility var. S2R = 3.40890  
 Reproducibility std. SR = 1.84632 --> 61.96% R = 5.1697  
 Remarks: none

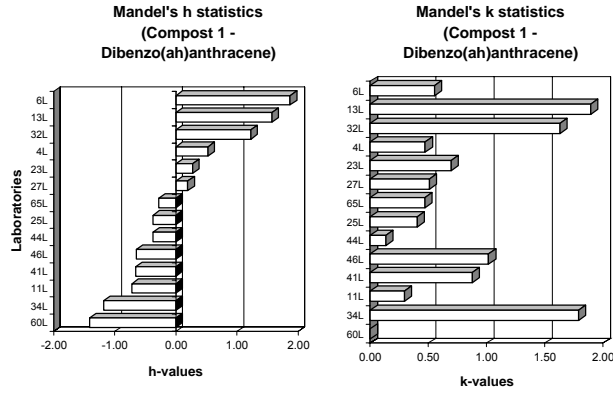




Sample: Compost 1  
 Element: Dibenzo(ah)anthracene

Unit: µg/kg

Mandel's k statistics (Compost 1 - Dibenzo(ah)anthracene)  
 Mandel's h statistics (Compost 1 - Dibenzo(ah)anthracene)  
 Compost 1 - Dibenzo(ah)anthracene -- Mean PARM = 74.32 [µg/kg]



General calc.parm.  
 T1= 3.27381E+03  
 T2= 2.77773E+05  
 T3= 43  
 T4= 149  
 T5= 3.2328E+03  
 n= variabel  
 p= 14  
 N-table= 3

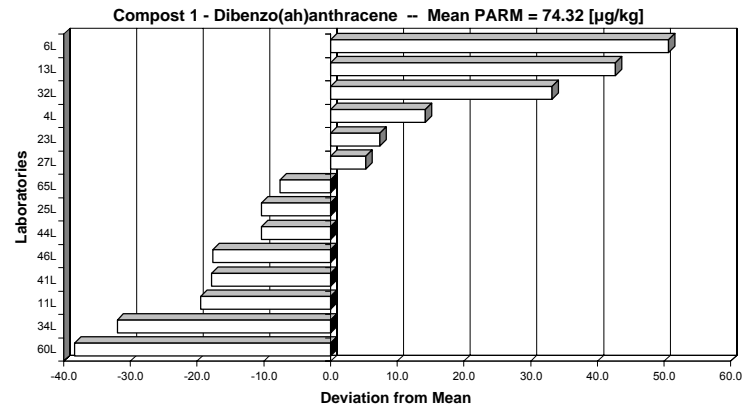
LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics		k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
					h	k								
60L	36.0000	-	1		-1.41			Fail	36.0000	-		1		-38.32
34L	42.3500	18.726	4		-1.18	1.79	!	Fail	42.3500	18.7262		4	3	-31.97
11L	54.8275	3.072	4		-0.72	0.29		Fail	54.8275	3.0716		4	3	-19.49
41L	56.5000	9.192	2		-0.66	0.88		Fail	56.5000	9.1924		2	1	-17.82
46L	56.6998	10.642	4		-0.65	1.02		Fail	56.6998	10.6423		4	3	-17.62
44L	64.0000	1.414	2		-0.38	0.14		Fail	64.0000	1.4142		2	1	-10.32
25L	64.0000	4.243	2		-0.38	0.41			64.0000	4.2426		2	1	-10.32
65L	66.7500	4.924	4		-0.28	0.47			66.7500	4.9244		4	3	-7.57
27L	79.5750	5.330	4		0.19	0.51			79.5750	5.3300		4	3	5.26
23L	81.7500	7.274	4		0.27	0.69			81.7500	7.2744		4	3	7.43
4L	88.5000	4.950	2		0.52	0.47		Fail	88.5000	4.9497		2	1	14.18
32L	107.5000	17.078	4		1.22	1.63	!	Fail	107.5000	17.0783		4	3	33.18
13L	117.0000	19.799	2		1.58	1.89		Fail	117.0000	19.7990		2	1	42.68
6L	125.0000	5.774	4	!	1.87	0.55		Fail	125.0000	5.7735		4	3	50.68
Tot.gem	74.318	8.648 µg/kg			1%-level:	2.30	(2.03)		14	74.3180	()	14	13	
Tot.std=	27.095	6.143			5%-level:	1.85	(1.69)							

RESULTS: Mean = 74.31802 µg/kg

Repeatability variance S2r = 111.47646  
 Repeatability std. Sr = 10.55824 --> 14.21% r = 29.5631

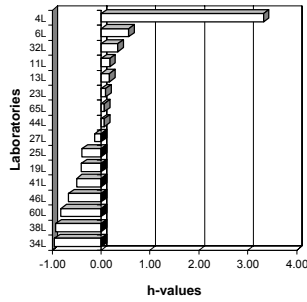
Between lab variance S2L = 684.76295  
 Reproducibility var. S2R = 796.23941  
 Reproducibility std. SR = 28.21771 --> 37.97% R = 79.0096

Remarks: none

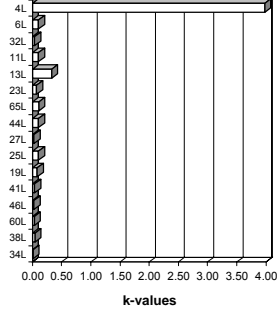


Sample: Sludge 1  
 Element: Dibenzo(ah)anthracene

Mandel's h statistics  
 (Sludge 1 -  
 Dibenzo(ah)anthracene)



Mandel's k statistics  
 (Sludge 1 -  
 Dibenzo(ah)anthracene)



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Dibenzo(ah)anthracene)  
 Mandel's h statistics (Sludge 1 - Dibenzo(ah)anthracene)  
 Sludge 1 - Dibenzo(ah)anthracene -- Mean PARM = 193.5 [ug/kg]

General calc.parm.  
 T1= 1.00947E+04  
 T2= 2.23079E+06  
 T3= 53  
 T4= 203  
 T5= 8.4761E+03  
 n= variabel 14  
 p= 4  
 N-table= 4

Mandel's statistics														End Result:		
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{x} > \text{AvST}+2\text{std}$	$\text{AvX} < \text{AvST}-2\text{std}$	PARM	Stdev	Rej.labs	N	N-1	dev_mean		
34L	77.5250	2.308	4		-0.96	0.01			77.5250	2.3085		4	3	-116.00		
38L	82.0000	9.092	4		-0.93	0.04			82.0000	9.0921		4	3	-111.52		
60L	100.2500	6.652	4		-0.82	0.03			100.2500	6.6521		4	3	-93.27		
46L	125.0000	5.774	4		-0.67	0.03			125.0000	5.7735		4	3	-68.52		
41L	152.0000	7.211	3		-0.50	0.03			152.0000	7.2111		3	2	-41.52		
19L	167.5000	17.078	4		-0.41	0.08			167.5000	17.0783		4	3	-26.02		
25L	170.2500	21.515	4		-0.39	0.10			170.2500	21.5155		4	3	-23.27		
27L	212.5000	6.245	4		-0.13	0.03			212.5000	6.2450		4	3	18.98		
44L	245.7500	21.793	4		0.07	0.11			245.7500	21.7926		4	3	52.23		
65L	246.0000	22.316	4		0.07	0.11			246.0000	22.3159		4	3	52.48		
23L	250.0000	14.142	4		0.09	0.07			250.0000	14.1421		4	3	56.48		
13L	262.7500	67.884	4		0.17	0.33								69.23		
11L	263.8700	21.321	3		0.18	0.10			263.8700	21.3213	.13L	3	2	70.35		
32L	290.0000	8.165	4		0.34	0.04			290.0000	8.1650		4	3	96.48		
6L	326.6667	20.817	3		0.56	0.10			326.6667	20.8167		3	2	133.14		
4L	780.0000	824.783	4	II	3.32	3.98	II	Fail			.4L			586.48		
Tot.gem	234.504	67.319 ug/kg		1%-level:	2.33	(1.88)			14	193.5223	(4L, 13L)	14	13			
Tot.std	184.342	202.568		5%-level:	1.86	(1.59)			2							

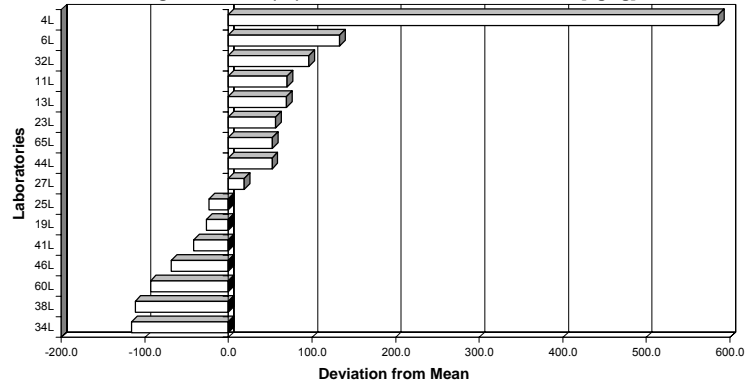
RESULTS: Mean = 193.52226 ug/kg

Repeatability variance S2r = 217.33592  
 Repeatability std. Sr = 14.74232 --> 7.62% r = 41.2785

Between lab variance S2L = 6208.36283  
 Reproducibility var. S2R = 6425.69875  
 Reproducibility std. SR = 80.16046 --> 41.42% R = 224.4493

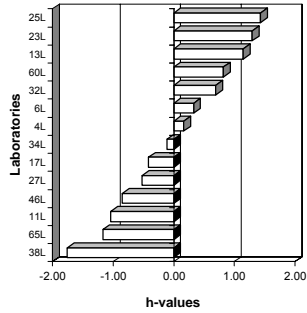
Remarks: 2 Labs rejected! (4L, 13L)

Sludge 1 - Dibenzo(ah)anthracene -- Mean PARM = 193.5 [ug/kg]

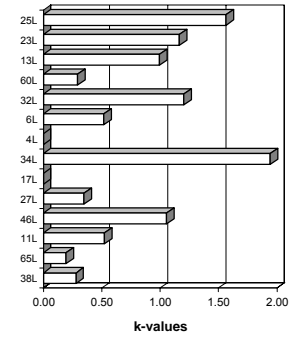


Sample: **Compost 1**  
 Element: **Fluoranthene**

Mandel's h statistics  
 (Compost 1 - Fluoranthene)



Mandel's k statistics  
 (Compost 1 - Fluoranthene)



Unit: µg/kg

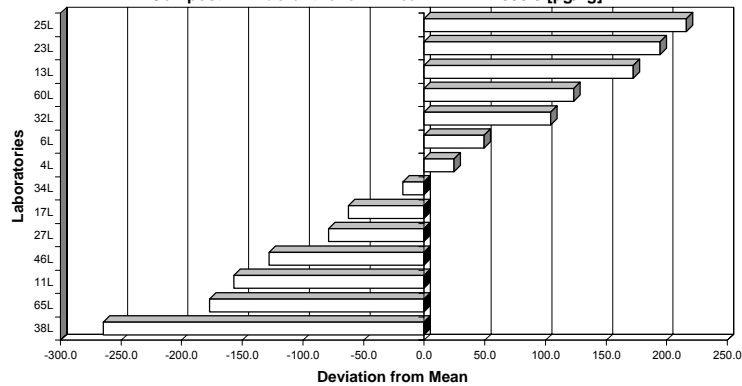
Mandel's k statistics (Compost 1 - Fluoranthene)  
 Mandel's h statistics (Compost 1 - Fluoranthene)  
 Compost 1 - Fluoranthene -- Mean PARM = 535.5 [µg/kg]

General calc.parm.  
 T1= 2.21104E+04  
 T2= 1.24836E+07  
 T3= 42  
 T4= 146  
 T5= 8.8936E+04  
 n= variabel  
 p= 14  
 N-table= 3

LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics		k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	End Result:		Rej.labs	N	N-1	dev_mean
					h	k			PARM	Stdev				
38L	271.0000	15.5562	2	-1.75	0.28		Fail		271.0000	15.5563		2	1	-264.50
65L	358.7500	10.874	4	-1.17	0.20		Fail		358.7500	10.8743		4	3	-176.75
11L	378.5275	29.155	4	-1.04	0.52		Fail		378.5275	29.1550		4	3	-156.97
46L	407.5000	58.523	4	-0.85	1.05		Fail		407.5000	58.5235		4	3	-128.00
27L	456.9250	19.448	4	-0.52	0.35		Fail		456.9250	19.4478		4	3	-78.58
17L	473.2000	-	1	-0.41					473.2000			1		-62.30
34L	518.1000	108.026	4	-0.12	1.94	II			518.1000	108.0262		4	3	-17.40
4L	560.0000	-	1	0.16					560.0000			1		24.50
6L	585.0000	28.868	4	0.33	0.52				585.0000	28.8675		4	3	49.50
32L	640.0000	66.833	4	0.69	1.20		Fail		640.0000	66.8331		4	3	104.50
60L	658.5000	16.263	2	0.82	0.29		Fail		658.5000	16.2635		2	1	123.00
13L	708.0000	55.154	2	1.14	0.99		Fail		708.0000	55.1543		2	1	172.50
23L	730.0000	64.807	4	1.29	1.17		Fail		730.0000	64.8074		4	3	194.50
25L	751.5000	86.974	2	1.43	1.57		Fail		751.5000	86.9741		2	1	216.00
Tot.gem	535.500	46.707 µg/kg			2.30	(2.02)		14	535.5002	()		14	13	
Tot.std=	150.876	31.444			1.85	(1.69)								

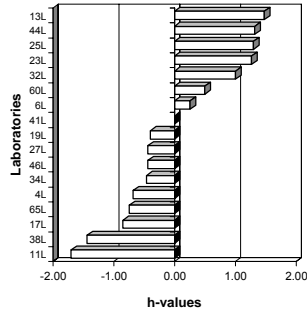
RESULTS: Mean = 535.50018 µg/kg  
 Repeatability variance S2r = 3176.30062  
 Repeatability std. Sr = 56.35868 --> 10.52% r = 157.8043  
 Between lab variance S2L = 20831.62952  
 Reproducibility var. S2R = 24007.93014  
 Reproducibility std. SR = 154.94493 --> 28.93% R = 433.8458  
 Remarks: none

Compost 1 - Fluoranthene -- Mean PARM = 535.5 [µg/kg]

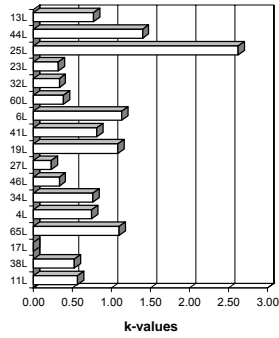


Sample: **Sludge 1**  
 Element: **Fluoranthene**

Mandel's h statistics  
 (Sludge 1 - Fluoranthene)



Mandel's k statistics  
 (Sludge 1 - Fluoranthene)



Unit: ug/kg

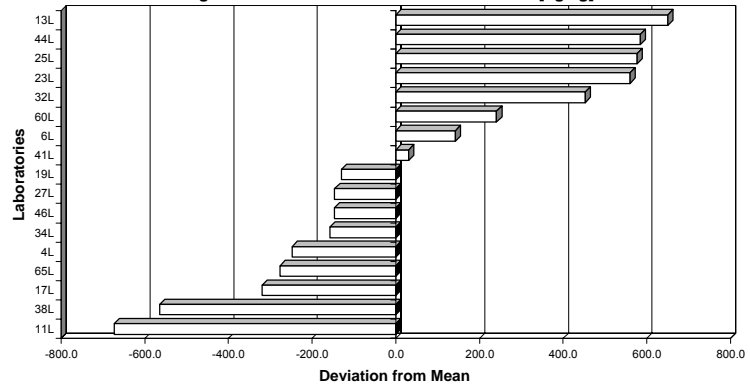
Mandel's k statistics (Sludge 1 - Fluoranthene)  
 Mandel's h statistics (Sludge 1 - Fluoranthene)  
 Sludge 1 - Fluoranthene -- Mean PARM = 2397 [ug/kg]

General calc.parm.  
 T1= 1.45472E+05  
 T2= 3.61732E+08  
 T3= 60  
 T4= 234  
 T5= 8.0912E+05  
 n= variabel  
 p= 16  
 N-table= 4

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
11L	1724.5033	97.514	3		-1.70	0.56		Fail	1724.5033	97.5135		3	2	-672.85
38L	1832.5000	90.692	4		-1.44	0.52		Fail	1832.5000	90.6918		4	3	-564.85
17L	2078.0000	-	1		-0.85			Fail	2078.0000	-		1		-319.35
65L	2120.7500	189.700	4		-0.75	1.10		Fail	2120.7500	189.7004		4	3	-276.60
4L	2150.0000	129.099	4		-0.68	0.75		Fail	2150.0000	129.0994		4	3	-247.35
34L	2240.3500	132.165	4		-0.46	0.76			2240.3500	132.1652		4	3	-157.00
46L	2250.0000	57.735	4		-0.44	0.33			2250.0000	57.7350		4	3	-147.35
27L	2251.2500	40.194	4		-0.43	0.23			2251.2500	40.1943		4	3	-146.10
19L	2267.5000	187.150	4		-0.39	1.08			2267.5000	187.1497		4	3	-129.85
41L	2427.5000	140.089	4		-0.01	0.81			2427.5000	140.0893		4	3	30.15
6L	2540.0000	195.789	4		0.26	1.13			2540.0000	195.7890		4	3	142.65
60L	2638.2500	66.970	4		0.50	0.39		Fail	2638.2500	66.9695		4	3	240.90
32L	2850.0000	57.735	4		1.01	0.33		Fail	2850.0000	57.7350		4	3	452.65
25L	2957.5000	55.603	4		1.26	0.32		Fail	2957.5000	55.6028		4	3	560.15
25L	2973.7500	454.328	4		1.30	2.63	II	Fail	-	-	25L	-	-	576.40
44L	2982.2500	241.795	4		1.32	1.40		Fail	2982.2500	241.7952		4	3	584.90
13L	3047.2500	133.097	4		1.48	0.77		Fail	3047.2500	133.0974		4	3	649.90
Tot.gem	2431.256	141.853 ug/kg		1%-level:	2.35	(1.88)			16	2397.3502	(25L)	16	15	
Tot.std=	416.169	102.415		5%-level:	1.87	(1.59)			1					

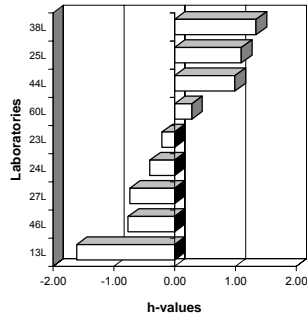
RESULTS: Mean = 2397.35021 ug/kg  
 Repeatability variance S2r = 18389.10064  
 Repeatability std. Sr = 135.60642 --> 5.66% r = 379.6980  
 Between lab variance S2L = 156059.71158  
 Reproducibility var. S2R = 174448.81222  
 Reproducibility std. SR = 417.67070 --> 17.42% R = 1169.4780  
 Remarks: 1 Lab rejected! (25L)

Sludge 1 - Fluoranthene -- Mean PARM = 2397 [ug/kg]

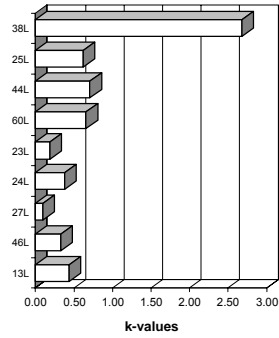


Sample: **Soil 3**  
 Element: **Fluoranthene**

**Mandel's h statistics  
 (Soil 3 - Fluoranthene)**



**Mandel's k statistics  
 (Soil 3 - Fluoranthene)**



Unit: µg/kg

Mandel's k statistics (Soil 3 - Fluoranthene)  
 Mandel's h statistics (Soil 3 - Fluoranthene)  
 Soil 3 - Fluoranthene -- Mean PARM = 4.43 [µg/kg]

General calc.parm.  
 T1= 1.33874E+02  
 T2= 6.95686E+02  
 T3= 30  
 T4= 116  
 T5= 8.9048E+00  
 n= variabel  
 p= 8  
 N-table= 4

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
13L	1.5000	0.577	4		-1.61	0.44			1.5000	0.5774		4	3	-2.93
46L	3.2186	0.437	4		-0.76	0.33		Fail	3.2186	0.4368		4	3	-1.21
27L	3.2750	0.126	4		-0.74	0.10			3.2750	0.1258		4	3	-1.16
24L	3.9500	0.495	2		-0.40	0.38			3.9500	0.4950		2	1	-0.48
23L	4.3500	0.252	4		-0.21	0.19			4.3500	0.2517		4	3	-0.08
60L	5.3500	0.866	4		0.28	0.66			5.3500	0.8660		4	3	0.92
44L	6.8000	0.931	4		1.00	0.71			6.8000	0.9309		4	3	2.37
25L	7.0000	0.816	4		1.10	0.62	II	Fail	7.0000	0.8165		4	3	2.57
38L	7.5000	3.536	2		1.34	2.68	II	Fail	-	-	,38L	-	-	3.07
Tot.gem	4.772	0.893 µg/kg		1%-level:	2.13	(1.82)			8	4.4305	(38L)	8	7	
Tot.std=	2.033	1.028		5%-level:	1.78	(1.57)			1					

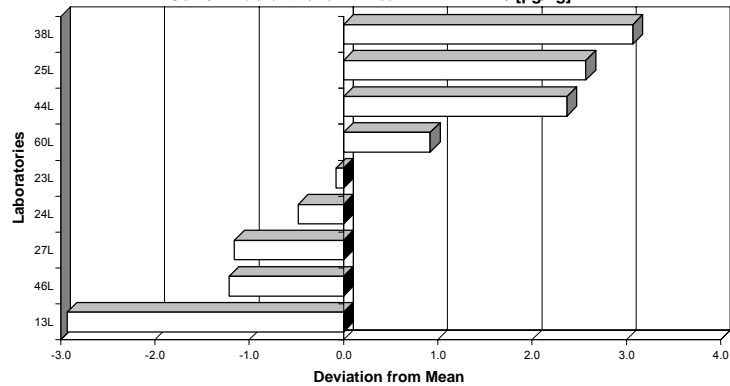
**RESULTS:** Mean = **4.43045** µg/kg

Repeatability variance **S2r = 0.40476**  
 Repeatability std. **Sr = 0.63621** --> 14.36% **r = 1.7814**

Between lab variance **S2L = 3.65203**  
 Reproducibility var. **S2R = 4.05679**  
 Reproducibility std. **SR = 2.01415** --> 45.46% **R = 5.6396**

Remarks: **1 Lab rejected! (38L)**

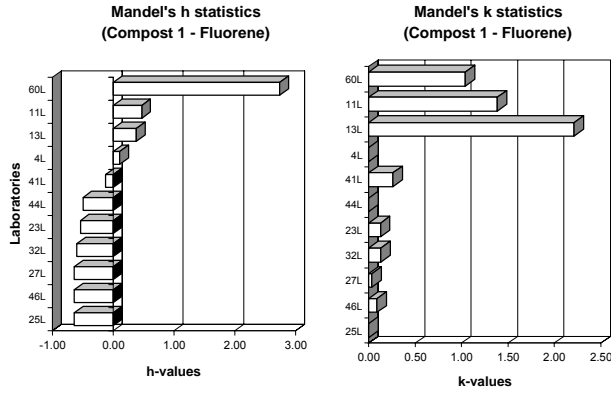
**Soil 3 - Fluoranthene -- Mean PARM = 4.43 [µg/kg]**



Sample: **Compost 1**  
 Element: **Fluorene**

Unit: µg/kg

Mandel's k statistics (Compost 1 - Fluorene)  
 Mandel's h statistics (Compost 1 - Fluorene)  
 Compost 1 - Fluorene -- Mean PARM = 16.84 [µg/kg]



General calc.parm.  
 T1= 4.16253E+02  
 T2= 1.27940E+04  
 T3= 26  
 T4= 84  
 T5= 3.1995E+02  
 n= variabel  
 p= 10  
 N-table= 3

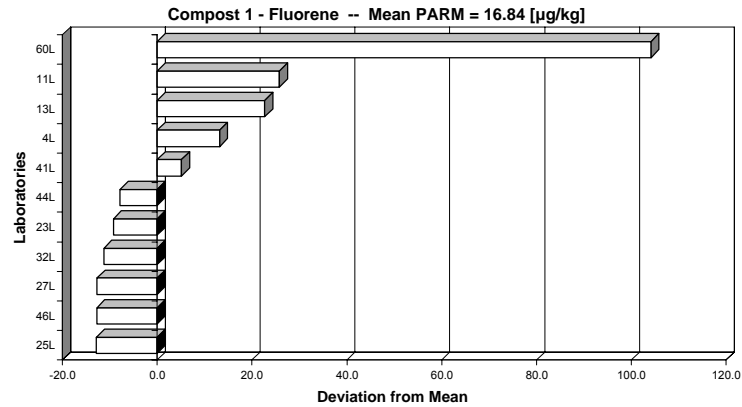
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{vX} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
25L	4.0000	-	1		-0.64			Fail	4.0000	-		1		-12.84
46L	4.0883	0.478	4		-0.64	0.09		Fail	4.0883	0.4781		4	3	-12.76
27L	4.1750	0.206	4		-0.64	0.04		Fail	4.1750	0.2062		4	3	-12.67
32L	5.5333	0.723	3		-0.60	0.13		Fail	5.5333	0.7234		3	2	-11.31
23L	7.5750	0.695	4		-0.54	0.13		Fail	7.5750	0.6946		4	3	-9.27
44L	9.0000	-	1		-0.50			Fail	9.0000	-		1		-7.84
41L	22.0000	1.414	2		-0.12	0.26			22.0000	1.4142		2	1	5.16
4L	30.0000	-	1		0.11				30.0000	-		1		13.16
13L	39.5000	12.021	2		0.38	2.21	I	Fail	39.5000	12.0208		2	1	22.66
11L	42.5750	7.531	4		0.47	1.39		Fail	42.5750	7.5308		4	3	25.73
60L	121.0000	5.657	2	II	2.73	1.04		Fail	-	-	.60L	-	-	104.16
Tot.gem	26.313	3.591 µg/kg		1%-level:	2.22	(1.97)			10	16.8447		10	9	
Tot.std=	34.642	4.365		5%-level:	1.82	(1.67)			1					

**RESULTS:** Mean = **16.84467** µg/kg

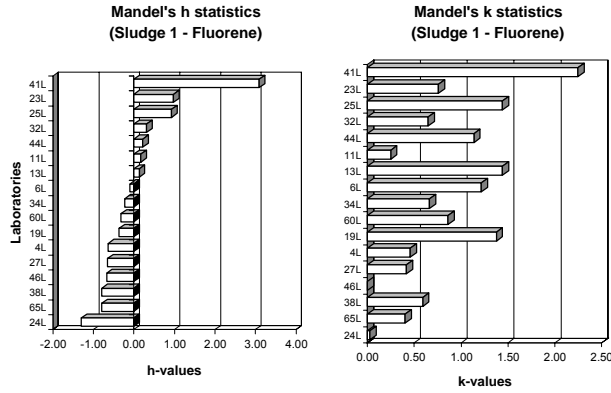
Repeatability variance S2r = 19.99664  
 Repeatability std. Sr = **4.47176** --> 26.55% r = 12.5209

Between lab variance S2L = 261.31312  
 Reproducibility var. S2R = 281.30976  
 Reproducibility std. SR = **16.77229** --> 99.57% R = 46.9624

Remarks: **1 Lab rejected! (60L)**



Sample: **Sludge 1**  
 Element: **Fluorene**



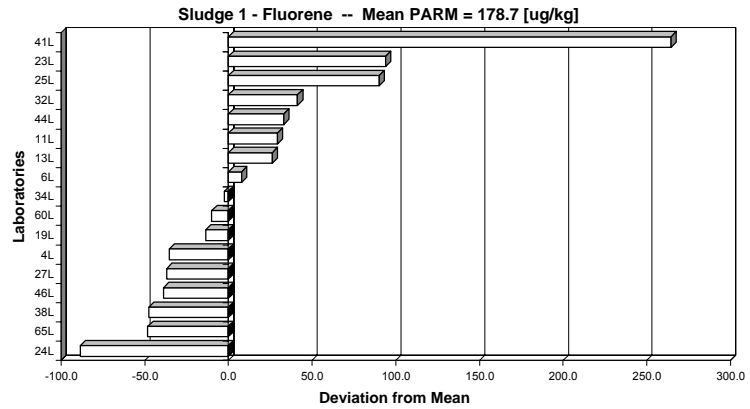
Unit: ug/kg

Mandel's k statistics (Sludge 1 - Fluorene)  
 Mandel's h statistics (Sludge 1 - Fluorene)  
 Sludge 1 - Fluorene -- Mean PARM = 178.7 [ug/kg]

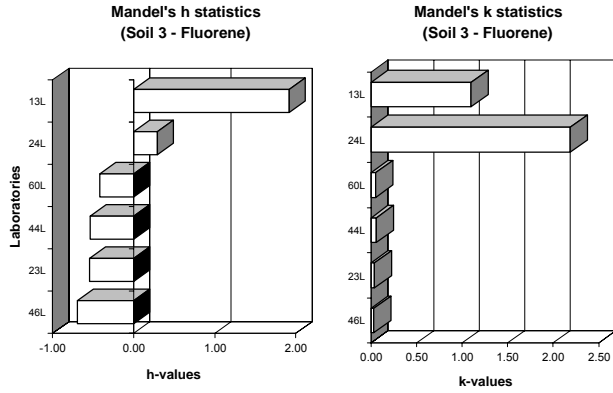
General calc.parm.  
 T1= 1.07189E+04  
 T2= 2.08163E+06  
 T3= 59  
 T4= 223  
 T5= 5.3995E+03  
 n= variabel  
 p= 16  
 N-table= 4

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{x} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
24L	90.2500	0.354	2		-1.29	0.03		Fail	90.2500	0.3536		2	1	-88.46
65L	130.5000	5.066	4		-0.79	0.40		Fail	130.5000	5.0662		4	3	-48.21
38L	131.0000	7.439	4		-0.78	0.59		Fail	131.0000	7.4386		4	3	-47.71
46L	140.0000		4		-0.67			Fail	140.0000			4	3	-38.71
27L	141.7500	5.252	4		-0.65	0.42		Fail	141.7500	5.2520		4	3	-36.96
4L	143.3333	5.774	3		-0.63	0.46		Fail	143.3333	5.7735		3	2	-35.38
19L	165.0000	17.321	4		-0.36	1.38		Fail	165.0000	17.3205		4	3	-13.71
60L	168.7500	10.813	4		-0.32	0.86		Fail	168.7500	10.8128		4	3	-9.96
34L	176.1000	8.313	4		-0.23	0.66		Fail	176.1000	8.3126		4	3	-2.61
6L	186.6667	15.275	3		-0.09	1.21			186.6667	15.2753		3	2	7.96
13L	205.0000	18.129	4		0.13	1.44			205.0000	18.1292		4	3	26.29
11L	208.0067	3.141	3		0.17	0.25			208.0067	3.1406		3	2	29.30
44L	211.7500	14.315	4		0.22	1.14	Fail		211.7500	14.3149		4	3	33.04
32L	220.0000	8.165	4		0.32	0.65	Fail		220.0000	8.1650		4	3	41.29
25L	268.7500	18.136	4		0.92	1.44	Fail		268.7500	18.1361		4	3	90.04
23L	272.5000	9.574	4		0.97	0.76	Fail		272.5000	9.5743		4	3	93.79
41L	443.2500	28.289	4	!!	3.09	2.25	!!	Fail	-	-	.41L	-	-	264.54
Tot.gem	194.271	10.315 ug/kg		1%-level:	2.35	(1.88)			16	178.7098	(41L)	16	15	
Tot.std=	80.628	7.431		5%-level:	1.87	(1.59)			1					

RESULTS: Mean = 178.70979 ug/kg  
 Repeatability variance S2r = 125.56942  
 Repeatability std. Sr = 11.20578 --> 6.27% r = 31.3762  
 Between lab variance S2L = 2397.09431  
 Reproducibility var. S2R = 2522.66373  
 Reproducibility std. SR = 50.22613 --> 28.10% R = 140.6332  
 Remarks: 1 Lab rejected! (41L)



Sample: **Soil 3**  
 Element: **Fluorene**



Unit: µg/kg

Mandel's k statistics (Soil 3 - Fluorene)  
 Mandel's h statistics (Soil 3 - Fluorene)  
 Soil 3 - Fluorene -- Mean PARM = 1.81 [µg/kg]

General calc.parm.  
 T1= 2.70309E+01  
 T2= 5.39673E+01  
 T3= 15  
 T4= 57  
 T5= 2.4959E-01  
 n= variabel  
 p= 4  
 N-table= 4

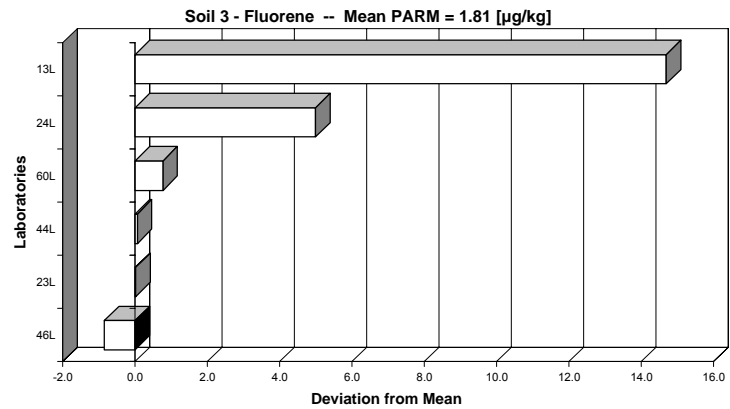
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	$AvX < AvST-2std$	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	0.9577	0.096	4		-0.69	0.03			0.9577	0.0965		4	3	-0.85
23L	1.8250	0.126	4		-0.55	0.04			1.8250	0.1258		4	3	0.02
44L	1.8667	0.208	3		-0.54	0.06			1.8667	0.2082		3	2	0.06
60L	2.5750	0.171	4		-0.42	0.05			2.5750	0.1708		4	3	0.77
24L	6.8000	7.354	2		0.29	2.19								4.99
13L	16.5000	3.697	4	II	1.92	1.10	II	Fail						14.69
Tot.gem	5.087	1.942 µg/kg		1%-level:	1.87	(1.77)			4	1.8061		4	3	
Tot.std	5.959	3.007		5%-level:	1.66	(1.54)			2					

RESULTS: Mean = 1.80610 µg/kg

Repeatability variance S2r = 0.02269  
 Repeatability std. Sr = 0.15063 --> 8.34% r = 0.4218

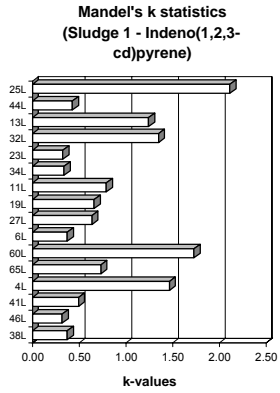
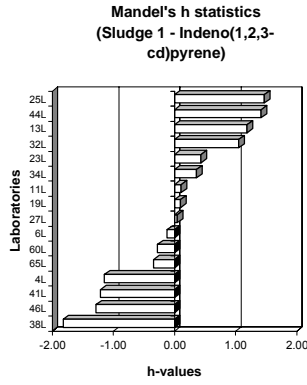
Between lab variance S2L = 0.46320  
 Reproducibility var. S2R = 0.48589  
 Reproducibility std. SR = 0.69706 --> 38.59% R = 1.9518

Remarks: 2 Labs rejected! (13L, 24L)





Sample: Sludge 1  
 Element: Indeno(1,2,3-cd)pyrene



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Indeno(1,2,3-cd)pyrene)  
 Mandel's h statistics (Sludge 1 - Indeno(1,2,3-cd)pyrene)  
 Sludge 1 - Indeno(1,2,3-cd)pyrene -- Mean PARM = 768 [ug/kg]

General calc.parm.  
 T1= 4.69690E+04  
 T2= 4.03308E+07  
 T3= 61  
 T4= 237  
 T5= 2.4495E+05  
 n= variabel  
 p= 16  
 N-table= 4

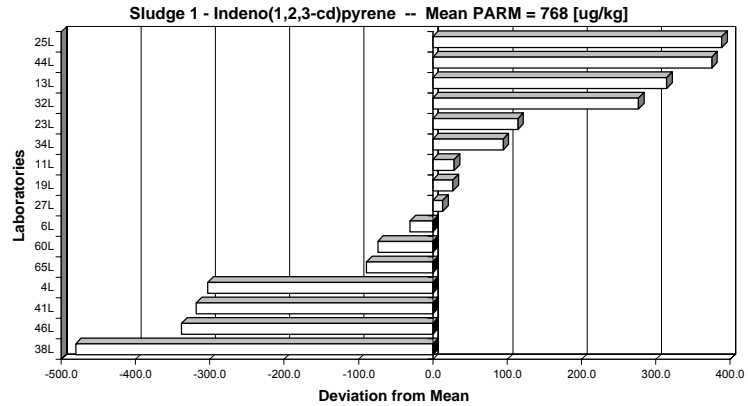
Mandel's statistics										End Result:					
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark	AvX > AvST+2std	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
38L	287.5000	28.723	4		-1.82	0.37		Fail		287.5000	28.7228		4	3	-480.53
46L	430.0000	24.495	4		-1.28	0.32		Fail		430.0000	24.4949		4	3	-338.03
41L	449.5000	37.890	4		-1.21	0.49		Fail		449.5000	37.8902		4	3	-318.53
4L	465.0000	112.694	4		-1.15	1.47		Fail		465.0000	112.6943		4	3	-303.03
65L	678.7500	56.293	4		-0.34	0.73		Fail		678.7500	56.2931		4	3	-89.28
60L	694.0000	132.936	2		-0.28	1.73				694.0000	132.9361		2	1	-74.03
6L	737.5000	28.723	4		-0.12	0.37				737.5000	28.7228		4	3	-30.53
27L	781.2500	49.040	4		0.05	0.64				781.2500	49.0399		4	3	13.22
19L	795.0000	50.662	4		0.10	0.66				795.0000	50.6623		4	3	26.97
11L	796.9467	60.899	3		0.11	0.79				796.9467	60.8993		3	2	28.92
34L	862.8000	25.993	4		0.36	0.34		Fail		862.8000	25.9929		4	3	94.77
23L	882.5000	25.000	4		0.43	0.33		Fail		882.5000	25.0000		4	3	114.47
32L	1045.0000	103.763	4		1.05	1.35		Fail		1045.0000	103.7625		4	3	275.97
13L	1082.5000	95.584	4		1.19	1.24		Fail		1082.5000	95.5842		4	3	314.47
44L	1143.5000	32.909	4		1.42	0.43		Fail		1143.5000	32.9090		4	3	375.47
25L	1156.7500	162.707	4		1.47	2.12	!!	Fail		1156.7500	162.7070		4	3	388.72
Tot.gem	768.031	64.269 ug/kg		1%-level:	2.33	(1.88)				16	768.0310	()	16	15	
Tot.std=	263.863	43.649		5%-level:	1.86	(1.59)									

RESULTS: Mean = 768.03104 ug/kg

Repeatability variance S2r = 5443.30236  
 Repeatability std. Sr = 73.77874 --> 9.61% r = 206.5805

Between lab variance S2L = 71500.49042  
 Reproducibility var. S2R = 76943.79278  
 Reproducibility std. SR = 277.38744 --> 36.12% R = 776.6848

Remarks: none

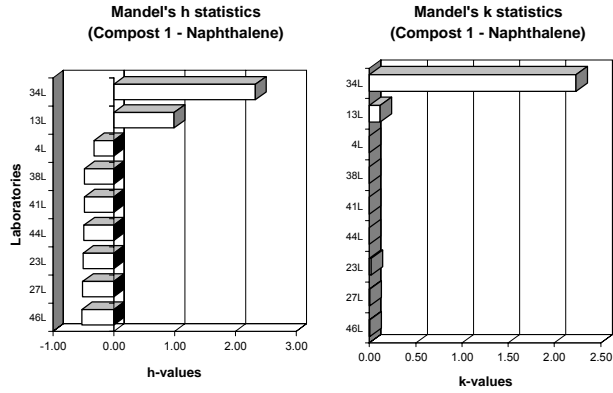


Sample: **Compost 1**  
 Element: **Naphthalene**

Unit: µg/kg

Mandel's k statistics (Compost 1 - Naphthalene)  
 Mandel's h statistics (Compost 1 - Naphthalene)  
 Compost 1 - Naphthalene -- Mean PARM = 7.91 [µg/kg]

General calc.parm.  
 T1= 1.02810E+02  
 T2= 7.51359E+02  
 T3= 15  
 T4= 51  
 T5= 1.6895E+00  
 n= variabel  
 p= 6  
 N-table= 2



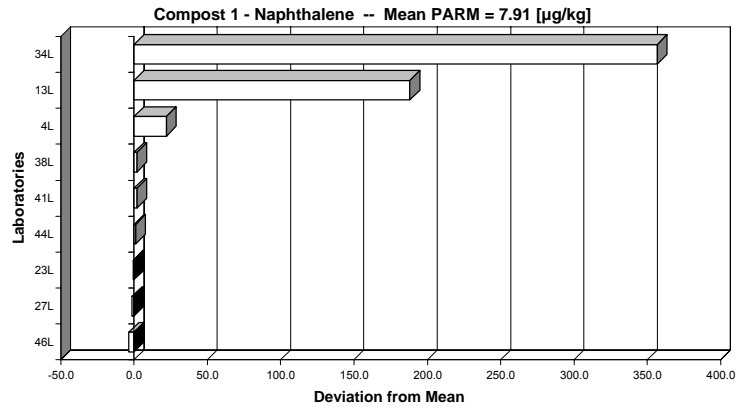
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	$AvX < AvST-2std$	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	4.5276	0.218	4		-0.53	0.01			4.5276	0.2175		4	3	-3.38
27L	6.7000	0.200	4		-0.51	0.01			6.7000	0.2000		4	3	-1.21
23L	7.2250	0.690	4		-0.50	0.02			7.2250	0.6898		4	3	-0.68
44L	9.0000	-	1		-0.49				9.0000	-		1	1	1.09
41L	10.0000	-	1		-0.48				10.0000	-		1	1	2.09
38L	10.0000	-	1		-0.48				10.0000	-		1	1	2.09
4L	30.0000	-	1		-0.32				-	-	4L	-	-	22.09
13L	196.0000	4.243	2		0.99	0.12	Fail		-	-	13L	-	-	188.09
34L	364.5250	80.471	4	II	2.33	2.23	II	Fail	-	-	34L	-	-	356.62
Tot.gem	70.886	17.164 µg/kg			1%-level:	2.13	(2.05)		6	7.9088	(4L,13L,34L)	6	5	
Tot.std=	126.179	35.430			5%-level:	1.78	(1.81)		3					

**RESULTS:** Mean = **7.90877** µg/kg

Repeatability variance **S2r = 0.18772**  
 Repeatability std. **Sr = 0.43327** --> 5.48% **r = 1.2131**

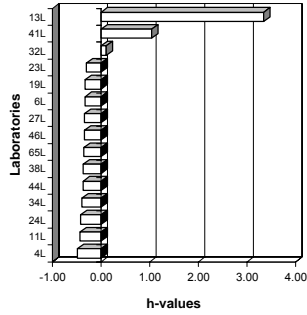
Between lab variance **S2L = 3.94444**  
 Reproducibility var. **S2R = 4.13216**  
 Reproducibility std. **SR = 2.03277** --> 25.70% **R = 5.6918**

Remarks: **3 Labs rejected! (4L,13L,34L)**

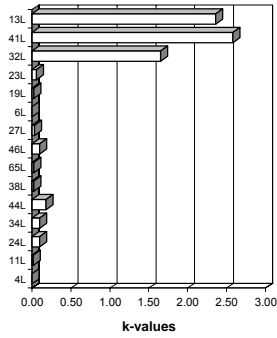


Sample: Sludge 1  
 Element: Naphthalene

Mandel's h statistics  
 (Sludge 1 - Naphthalene)



Mandel's k statistics  
 (Sludge 1 - Naphthalene)



Unit: ug/kg

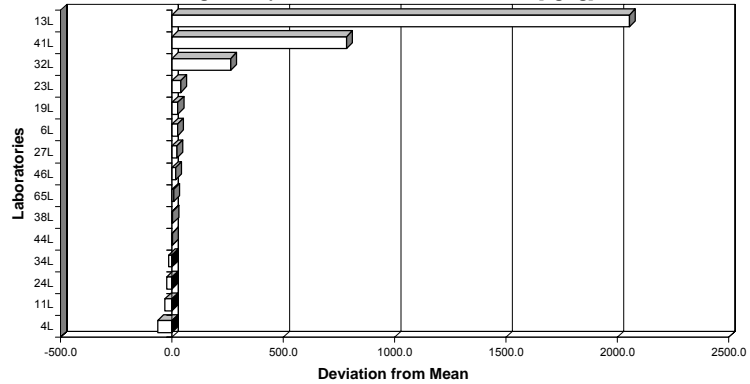
Mandel's k statistics (Sludge 1 - Naphthalene)  
 Mandel's h statistics (Sludge 1 - Naphthalene)  
 Sludge 1 - Naphthalene -- Mean PARM = 75.58 [ug/kg]

General calc.parm.  
 T1= 3.36121E+03  
 T2= 2.95286E+05  
 T3= 42  
 T4= 154  
 T5= 1.7589E+03  
 n= variabel  
 p= 12  
 N-table= 4

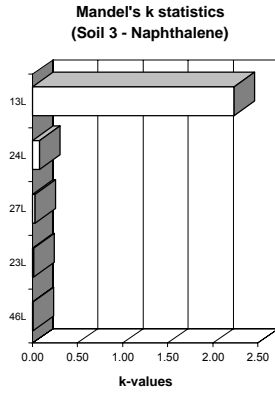
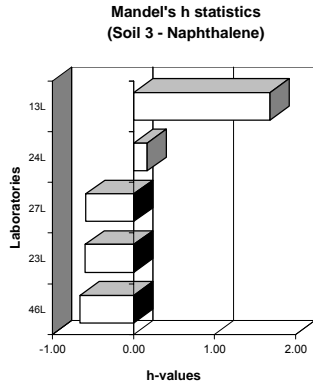
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark	AvX > AvST+2std	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
4L	10.0000		2		-0.49			Fail		10.0000			2	1	-65.58
11L	43.3900	1.926	3		-0.43	0.02		Fail		43.3900	1.9260		3	2	-32.19
24L	51.5000	9.617	2		-0.42	0.10		Fail		51.5000	9.6167		2	1	-24.08
34L	61.1675	9.725	4		-0.40	0.10		Fail		61.1675	9.7254		4	3	-14.41
44L	77.0000	17.455	4		-0.37	0.18		Fail		77.0000	17.4547		4	3	1.42
38L	78.5000	2.380	4		-0.37	0.02		Fail		78.5000	2.3805		4	3	2.92
65L	82.5000	2.646	4		-0.36	0.03		Fail		82.5000	2.6458		4	3	6.92
46L	90.7176	9.541	4		-0.35	0.10		Fail		90.7176	9.5407		4	3	15.14
27L	96.2500	3.403	4		-0.34	0.04		Fail		96.2500	3.4034		4	3	20.67
6L	100.0000		3		-0.33			Fail		100.0000			3	2	24.42
19L	100.8750	2.271	4		-0.33	0.02		Fail		100.8750	2.2706		4	3	25.30
23L	115.0000	5.774	4		-0.30	0.06				115.0000	5.7735		4	3	39.42
32L	337.5000	160.702	4		0.10	1.65	I			-	-	,32L	-	-	261.92
41L	858.5000	250.579	4		1.04	2.58	II	Fail		-	-	,41L	-	-	782.92
13L	2129.7500	229.093	4	II	3.35	2.36	II	Fail		-	-	,13L	-	-	2054.17
Tot.gem	282.177	47.007 ug/kg		1%-level:	2.32	(1.87)				12	75.5750	(13L,41L,32L)	12	11	
Tot.std	552.305	88.075		5%-level:	1.86	(1.59)				3					

RESULTS: Mean = 75.57501 ug/kg  
 Repeatability variance S2r = 58.63150  
 Repeatability std. Sr = 7.65712 --> 10.13% r = 21.4399  
 Between lab variance S2L = 669.07383  
 Reproducibility var. S2R = 727.70533  
 Reproducibility std. SR = 26.97601 --> 35.69% R = 75.5328  
 Remarks: 3 Labs rejected! (13L,41L,32L)

Sludge 1 - Naphthalene -- Mean PARM = 75.58 [ug/kg]



Sample: **Soil 3**  
 Element: **Naphthalene**



Unit: µg/kg

Mandel's k statistics (Soil 3 - Naphthalene)  
 Mandel's h statistics (Soil 3 - Naphthalene)  
 Soil 3 - Naphthalene -- Mean PARM = 7.46 [µg/kg]

General calc.parm.  
 T1= 7.25000E+01  
 T2= 1.03395E+03  
 T3= 12  
 T4= 40  
 T5= 2.3400E+00  
 n= variabel 4  
 p= 4  
 N-table= 3

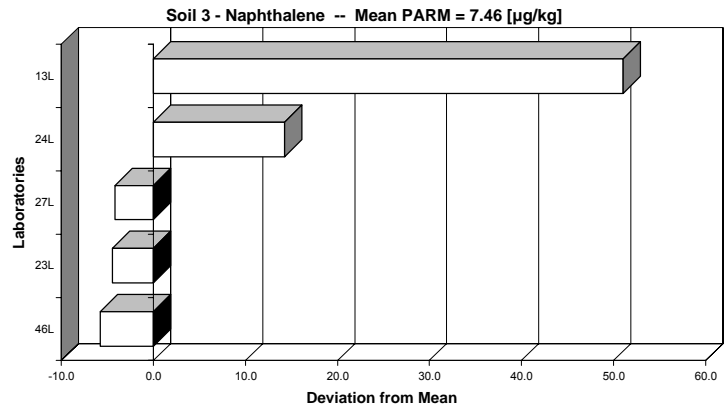
LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics		k-mark	k-mark > AvST+2std	AvX < AvST-2std	End Result:			N	N-1	dev_mean
					h	k				PARM	Stdev	Rej.labs			
46L	1.7000	0.141	2		-0.66	0.01				1.7000	0.1414		2	1	-5.76
23L	3.0750	0.250	4		-0.60	0.02				3.0750	0.2500		4	3	-4.39
27L	3.3250	0.479	4		-0.59	0.03				3.3250	0.4787		4	3	-4.14
24L	21.7500	1.202	2		0.17	0.08				21.7500	1.2021		2	1	14.29
13L	58.5000	32.296	4	I	1.68	2.23	II	Fail		-	-	13L	-	4	51.04
Tot.gem	17.670	6.874 µg/kg			1.72	(1.85)			4	7.4625	(13L)			3	
Tot.std=	24.277	14.217			1.57	(1.62)			1						

**RESULTS:** Mean = 7.46250 µg/kg

Repeatability variance S2r = 0.29250  
 Repeatability std. Sr = 0.54083 --> 7.25% r = 1.5143

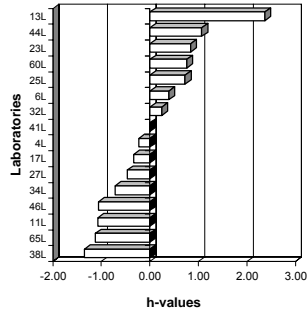
Between lab variance S2L = 68.65981  
 Reproducibility var. S2R = 68.95231  
 Reproducibility std. SR = 8.30375 --> 111.27% R = 23.2505

Remarks: 1 Lab rejected! (13L)

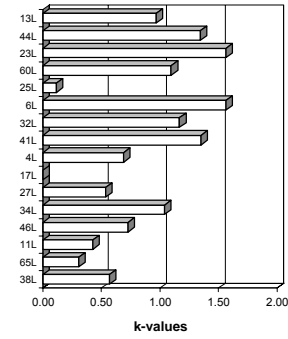


Sample: **Compost 1**  
 Element: **Phenanthrene**

Mandel's h statistics  
 (Compost 1 - Phenanthrene)



Mandel's k statistics  
 (Compost 1 - Phenanthrene)



Unit: µg/kg

Mandel's k statistics (Compost 1 - Phenanthrene)  
 Mandel's h statistics (Compost 1 - Phenanthrene)  
 Compost 1 - Phenanthrene -- Mean PARM = 106.9 [µg/kg]

General calc.parm.  
 T1= 6.43282E+03  
 T2= 7.57265E+05  
 T3= 60  
 T4= 234  
 T5= 5.2130E+03  
 n= variabel  
 p= 16  
 N-table= 4

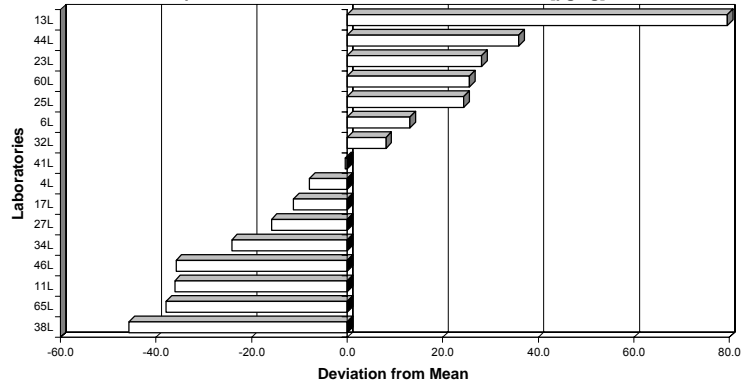
Mandel's statistics										End Result:					
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark	AvX > AvST+2std	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
38L	61.2500	6.292	4		-1.35	0.57		Fail		61.2500	6.2915		4	3	-45.62
65L	69.0000	3.367	4		-1.12	0.30		Fail		69.0000	3.3665		4	3	-37.87
11L	70.7825	4.712	4		-1.07	0.43		Fail		70.7825	4.7121		4	3	-36.09
46L	71.0462	8.051	4		-1.06	0.73		Fail		71.0462	8.0511		4	3	-35.62
34L	82.7000	11.510	4		-0.72	1.04		Fail		82.7000	11.5103		4	3	-24.17
27L	91.0250	5.923	4		-0.47	0.54		Fail		91.0250	5.9230		4	3	-15.84
17L	95.6000	-	1		-0.33			Fail		95.6000	-		1		-11.27
4L	99.0000	7.616	4		-0.23	0.69				99.0000	7.6158		4	3	-7.87
41L	106.5000	14.933	4		-0.01	1.35				106.5000	14.9332		4	3	-0.37
32L	115.0000	12.910	4		0.24	1.17				115.0000	12.9099		4	3	8.13
6L	120.0000	17.321	3		0.39	1.56	Fail			120.0000	17.3205		3	2	13.13
25L	131.2500	1.258	4		0.72	0.11	Fail			131.2500	1.2583		4	3	24.38
60L	132.5000	12.124	4		0.76	1.10	Fail			132.5000	12.1244		4	3	25.63
23L	135.0000	17.321	4		0.83	1.56	Fail			135.0000	17.3205		4	3	28.13
44L	142.7500	14.863	4		1.06	1.34	Fail			142.7500	14.8633		4	3	35.88
13L	186.5000	10.724	4	!!	2.36	0.97	Fail			186.5000	10.7238		4	3	79.63
Tot.gem	106.869	9.928 µg/kg			1%-level:	2.33 (1.87)			16	106.8691	()		16	15	
Tot.std=	33.699	5.065			5%-level:	1.86 (1.59)									

RESULTS: Mean = 106.86911 µg/kg

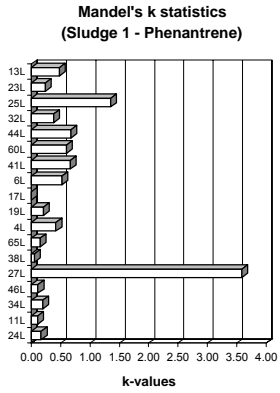
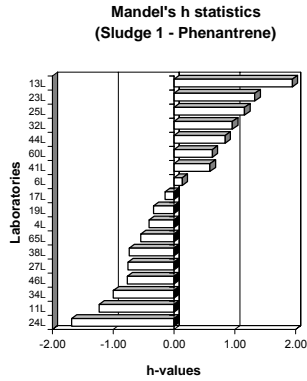
Repeatability variance S2r = 118.47799  
 Repeatability std. Sr = 10.88476 --> 10.19% r = 30.4773  
 Between lab variance S2L = 1172.91460  
 Reproducibility var. S2R = 1291.39259  
 Reproducibility std. SR = 35.93595 --> 33.63% R = 100.6207

Remarks: none

Compost 1 - Phenanthrene -- Mean PARM = 106.9 [µg/kg]



Sample: **Sludge 1**  
 Element: **Phenantrene**



Unit: ug/kg

Mandel's k statistics (Sludge 1 - Phenantrene)  
 Mandel's h statistics (Sludge 1 - Phenantrene)  
 Sludge 1 - Phenantrene -- Mean PARM = 1200 [ug/kg]

General calc.parm.  
 T1= 7.10486E+04  
 T2= 9.37944E+07  
 T3= 58  
 T4= 222  
 T5= 1.5343E+05  
 n= variabel  
 p= 16  
 N-table= 4

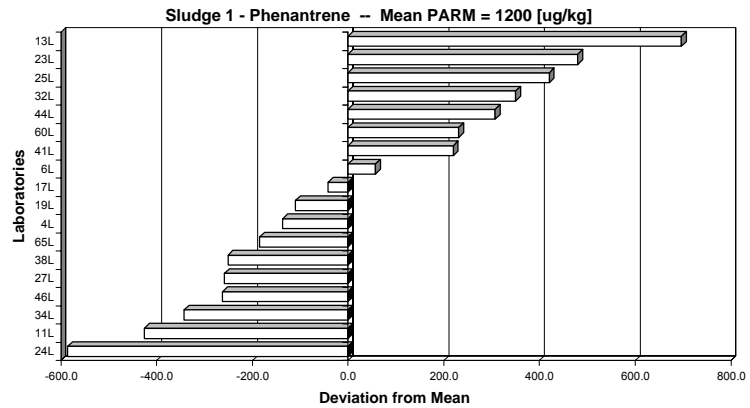
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
24L	614.6000	25.456	2		-1.68	0.17		Fail	614.6000	25.456		2	1	-585.64
11L	774.8675	16.297	4		-1.23	0.11		Fail	774.8675	16.297		4	3	-425.37
34L	857.9500	29.751	4		-1.00	0.20		Fail	857.9500	29.751		4	3	-342.29
46L	937.5401	17.149	4		-0.77	0.11		Fail	937.5401	17.149		4	3	-262.70
27L	942.2500	545.699	4		-0.76	3.59		Fail						-257.99
38L	949.2500	8.057	4		-0.74	0.05	II		949.2500	8.057	27L	4	3	-250.99
65L	1015.2500	23.329	4		-0.55	0.15		Fail	1015.2500	23.329		4	3	-184.99
4L	1063.3333	63.509	3		-0.41	0.42			1063.3333	63.509		3	2	-136.90
19L	1090.0000	31.623	4		-0.34	0.21			1090.0000	31.623		4	3	-110.24
17L	1158.0000	-	1		-0.15				1158.0000	-		1		-42.24
6L	1257.5000	79.320	4		0.14	0.52			1257.5000	79.320		4	3	57.26
41L	1420.0000	101.325	4		0.60	0.67			1420.0000	101.325		4	3	219.76
60L	1431.2500	90.691	4		0.63	0.60			1431.2500	90.691		4	3	231.01
44L	1507.7500	102.477	4		0.85	0.67	Fail		1507.7500	102.477		4	3	307.51
32L	1550.0000	57.735	4		0.97	0.38	Fail		1550.0000	57.735		4	3	349.76
25L	1620.5000	204.857	4		1.16	1.35	Fail				25L			420.26
23L	1680.0000	36.515	4		1.33	0.24	Fail		1680.0000	36.515		4	3	479.76
13L	1896.5000	72.344	4	I	1.95	0.48	Fail		1896.5000	72.344		4	3	696.26
Tot.gem	1209.252	88.596 ug/kg			1% level:	2.36 (1.88)			16	1200.2369	(27L, 25L)	16	15	
Tot.stdev	353.011	127.288			5% level:	1.88 (1.59)			2					

RESULTS: Mean = 1200.23693 ug/kg

Repeatability variance S2r = 3653.14539  
 Repeatability std. Sr = 60.44126 --> 5.04% r = 169.2355

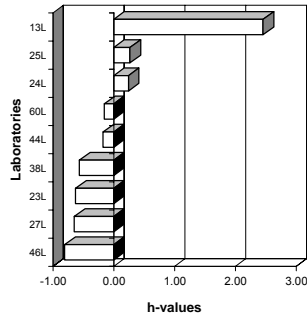
Between lab variance S2L = 123803.64213  
 Reproducibility var. S2R = 127456.78752  
 Reproducibility std. SR = 357.01091 --> 29.75% R = 999.6305

Remarks: 2 Labs rejected! (27L, 25L)

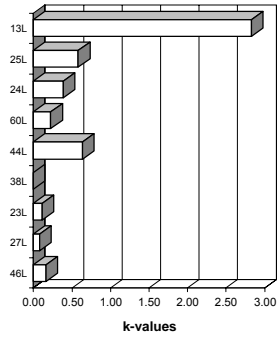


Sample: **Soil 3**  
 Element: **Phenantrene**

**Mandel's h statistics  
 (Soil 3 - Phenantrene)**



**Mandel's k statistics  
 (Soil 3 - Phenantrene)**



Unit: µg/kg

Mandel's k statistics (Soil 3 - Phenantrene)  
 Mandel's h statistics (Soil 3 - Phenantrene)  
 Soil 3 - Phenantrene -- Mean PARM = 7.09 [µg/kg]

General calc.parm.  
 T1= 1.85689E+02  
 T2= 1.54324E+03  
 T3= 27  
 T4= 97  
 T5= 6.1124E+00  
 n= variabel 8  
 p= 3  
 N-table= 3

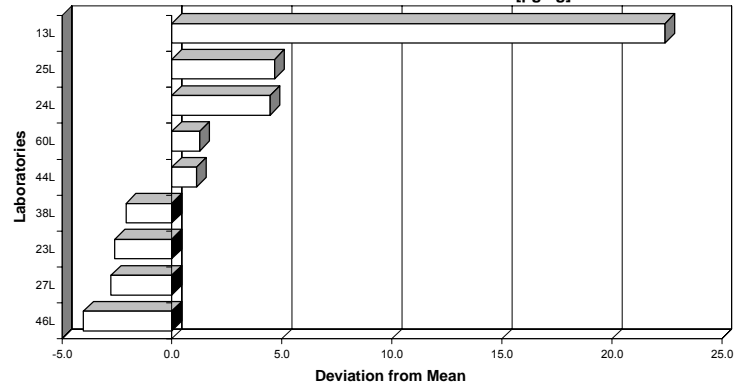
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
46L	3.0723	0.271	4		-0.80	0.16		Fail	3.0723	0.2708		4	3	-4.02
27L	4.3250	0.126	4		-0.65	0.08		Fail	4.3250	0.1258		4	3	-2.77
23L	4.5000	0.183	4		-0.63	0.11		Fail	4.5000	0.1826		4	3	-2.59
38L	5.0000		2		-0.57			Fail	5.0000			2	1	-2.09
44L	8.2000	1.044	3		-0.17	0.63			8.2000	1.0440		3	2	1.11
60L	8.3500	0.370	4		-0.15	0.22			8.3500	0.3697		4	3	1.26
24L	11.5500	0.636	2		0.24	0.39			11.5500	0.6364		2	1	4.46
25L	11.7500	0.957	4		0.27	0.58			11.7500	0.9574		4	3	4.66
13L	29.5000	4.655	4	II	2.46	2.83	II	Fail	-	-	,13L	-	-	22.41
Tot.gem	9.583	0.916 µg/kg			1%-level: 2.13	(1.99)			8	7.0934		8	7	
Tot.std=	8.105	1.449			5%-level: 1.78	(1.68)			1					

**RESULTS:** Mean = **7.09341** µg/kg

Repeatability variance **S2r = 0.32171**  
 Repeatability std. **Sr = 0.56719** --> 8.00% **r = 1.5881**  
 Between lab variance **S2L = 11.27580**  
 Reproducibility var. **S2R = 11.59750**  
 Reproducibility std. **SR = 3.40551** --> 48.01% **R = 9.5354**

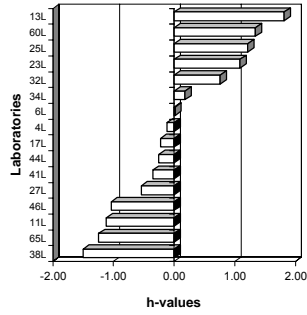
Remarks: **1 Lab rejected! (13L)**

**Soil 3 - Phenantrene -- Mean PARM = 7.09 [µg/kg]**

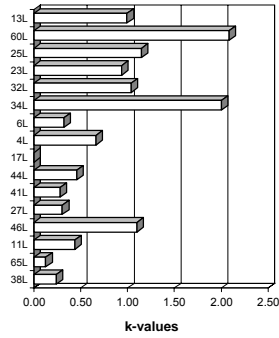


Sample: **Compost 1**  
 Element: **Pyrene**

Mandel's h statistics  
 (Compost 1 - Pyrene)



Mandel's k statistics  
 (Compost 1 - Pyrene)



Unit:  $\mu\text{g/kg}$

Mandel's k statistics (Compost 1 - Pyrene)  
 Mandel's h statistics (Compost 1 - Pyrene)  
 Compost 1 - Pyrene -- Mean PARM = 448.3 [ $\mu\text{g/kg}$ ]

General calc.parm.  
 T1= 2.69924E+04  
 T2= 1.30221E+07  
 T3= 60  
 T4= 234  
 T5= 1.4553E+05  
 n= variabel  
 p= 16  
 N-table= 4

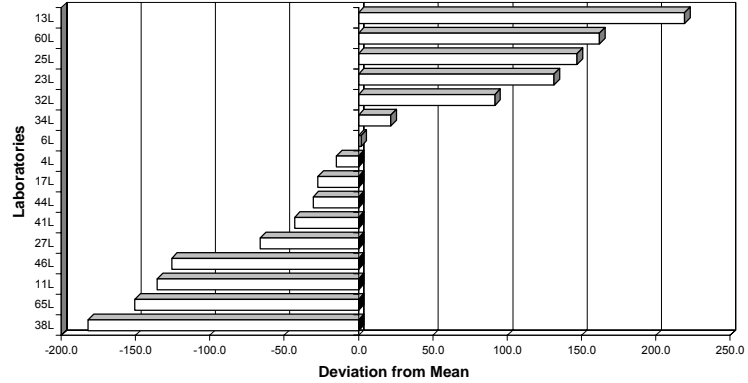
LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics		k-mark	k-mark $\text{vs } X > \text{AvST}+2\text{std}$	AvX < AvST-2std	End Result:		Rej.labs	N	N-1	dev_mean
					h	k				PARM	Stdev				
38L	266.2500	13.7689	4	-1.50	0.24			Fail	266.2500	13.7689		4	3	-182.01	
65L	297.7500	7.1822	4	-1.24	0.13			Fail	297.7500	7.1822		4	3	-150.51	
11L	312.8650	24.9289	4	-1.12	0.44			Fail	312.8650	24.9289		4	3	-135.39	
46L	322.5000	62.9153	4	-1.04	1.10			Fail	322.5000	62.9153		4	3	-125.76	
27L	382.1000	17.3996	4	-0.55	0.30				382.1000	17.3996		4	3	-66.16	
41L	405.2500	16.0909	4	-0.35	0.28				405.2500	16.0909		4	3	-43.01	
44L	417.7500	26.0944	4	-0.25	0.46				417.7500	26.0944		4	3	-30.51	
17L	420.9000	-	1	-0.23					420.9000	-		1		-27.36	
4L	433.3333	37.8594	3	-0.12	0.66				433.3333	37.8594		3	2	-14.92	
6L	450.0000	18.2574	4	0.01	0.32				450.0000	18.2574		4	3	1.74	
34L	469.9000	114.4033	4	0.18	2.00	II			469.9000	114.4027		4	3	21.64	
32L	540.0000	59.4422	4	0.76	1.04		Fail		540.0000	59.4418		4	3	91.74	
23L	580.0000	53.5413	4	1.09	0.94		Fail		580.0000	53.5413		4	3	131.74	
25L	595.2500	65.5153	4	1.21	1.15		Fail		595.2500	65.5153		4	3	146.99	
60L	610.5000	118.9692	4	1.34	2.08	II	Fail		610.5000	118.9692		4	3	162.24	
13L	667.7500	56.7825	4	1.81	0.99		Fail		667.7500	56.7825		4	3	219.49	
Tot.gem	448.256	46.210 $\mu\text{g/kg}$			2.33	(1.87)			16	448.2561	()		16	15	
Tot.std=	121.217	34.803			1.86	(1.59)									

RESULTS: Mean = **448.25615**  $\mu\text{g/kg}$

Repeatability variance S2r = 3307.53852  
 Repeatability std. Sr = **57.51120** --> 12.83% r = 161.0314  
 Between lab variance S2L = 14783.94484  
 Reproducibility var. S2R = 18091.48336  
 Reproducibility std. SR = **134.50458** --> 30.01% R = 376.6128

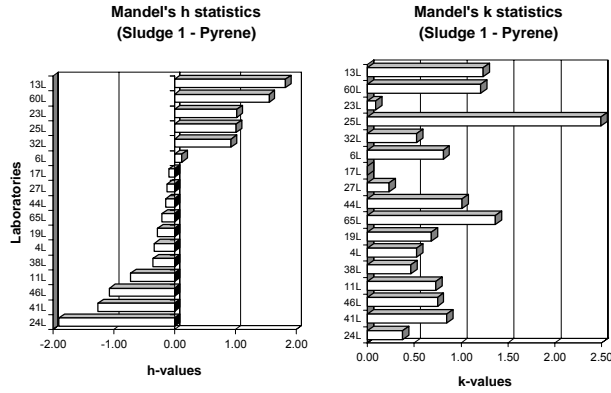
Remarks: none

Compost 1 - Pyrene -- Mean PARM = 448.3 [ $\mu\text{g/kg}$ ]





Sample: **Sludge 1**  
 Element: **Pyrene**



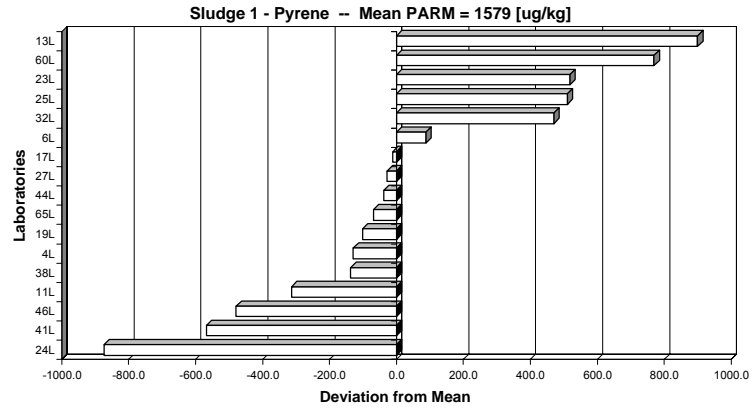
Unit: ug/kg

Mandel's k statistics (Sludge 1 - Pyrene)  
 Mandel's h statistics (Sludge 1 - Pyrene)  
 Sludge 1 - Pyrene -- Mean PARM = 1579 [ug/kg]

General calc.parm.  
 T1= 9.36819E+04  
 T2= 1.63077E+08  
 T3= 58  
 T4= 222  
 T5= 3.4054E+05  
 n= variabel  
 p= 16  
 N-table= 4

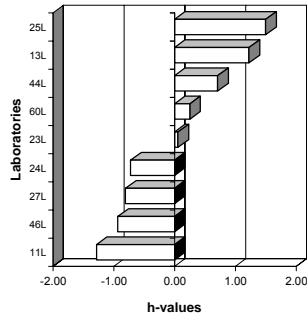
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
24L	705.1500	41.224	2	I	-1.90	0.38	Fail		705.1500	41.2243		2	1	-873.89
41L	1011.7500	92.291	4		-1.26	0.85	Fail		1011.7500	92.2908		4	3	-567.29
46L	1100.0000	81.650	4		-1.07	0.75	Fail		1100.0000	81.6497		4	3	-479.04
11L	1265.1967	80.031	3		-0.72	0.73	Fail		1265.1967	80.0307		3	2	-313.84
38L	1442.5000	50.580	4		-0.35	0.46	Fail		1442.5000	50.5800		4	3	-136.54
4L	1450.0000	57.735	4		-0.33	0.53	Fail		1450.0000	57.7350		4	3	-129.04
19L	1477.5000	74.554	4		-0.28	0.68	Fail		1477.5000	74.5542		4	3	-101.54
65L	1510.5000	149.244	4		-0.21	1.37			1510.5000	149.2436		4	3	-68.54
44L	1541.5000	110.684	4		-0.14	1.01			1541.5000	110.6842		4	3	-37.54
27L	1551.2500	25.198	4		-0.12	0.23			1551.2500	25.1976		4	3	-27.79
17L	1567.0000	-	1		-0.09				1567.0000			1		-12.04
6L	1667.5000	88.459	4		0.12	0.81			1667.5000	88.4590		4	3	88.46
32L	2050.0000	57.735	4		0.93	0.53	Fail		2050.0000	57.7350		4	3	470.96
25L	2090.0000	272.120	4		1.01	2.49	II	Fail			25L			510.96
23L	2097.5000	9.574	4		1.03	0.09	Fail		2097.5000	9.5743		4	3	518.46
60L	2348.7500	131.968	4		1.56	1.21	Fail		2348.7500	131.9681		4	3	769.71
13L	2478.5000	134.978	4		1.83	1.24	Fail		2478.5000	134.9778		4	3	899.46
Tot.gem	1609.094	91.127 ug/kg		1%-level:	2.35	(1.88)			16	1579.0373	(25L)	16	15	
Tot.std=	475.115	62.165		5%-level:	1.87	(1.59)			1					

RESULTS: Mean = 1579.03729 ug/kg  
 Repeatability variance S2r = 8108.20284  
 Repeatability std. Sr = 90.04556 --> 5.70% r = 252.1276  
 Between lab variance S2L = 214874.92648  
 Reproducibility var. S2R = 222983.12932  
 Reproducibility std. SR = 472.21089 --> 29.90% R = 1322.1905  
 Remarks: 1 Lab rejected! (25L)

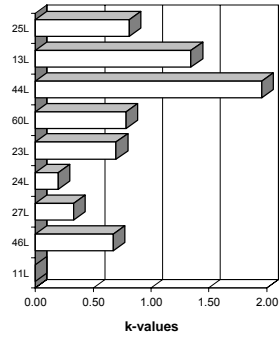


Sample: **Soil 3**  
 Element: **Pyrene**

**Mandel's h statistics  
 (Soil 3 - Pyrene)**



**Mandel's k statistics  
 (Soil 3 - Pyrene)**



Unit:  $\mu\text{g/kg}$

**Mandel's k statistics (Soil 3 - Pyrene)**  
**Mandel's h statistics (Soil 3 - Pyrene)**  
 Soil 3 - Pyrene -- Mean PARM = 7.08 [ $\mu\text{g/kg}$ ]

General calc.parm.  
 T1= 2.20585E+02  
 T2= 1.73237E+03  
 T3= 30  
 T4= 110  
 T5= 1.1769E+01  
 n= variabel 9  
 p= 9  
 N-table= 3

Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{X} > \text{AvST}+2\text{std}$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
11L	4.2800	-	1		-1.28			Fail	4.2800	-		1		-2.80
46L	5.0512	0.479	4		-0.93	0.67		Fail	5.0512	0.4795		4	3	-2.03
27L	5.3250	0.236	4		-0.80	0.33		Fail	5.3250	0.2363		4	3	-1.75
24L	5.5000	0.141	2		-0.72	0.20		Fail	5.5000	0.1414		2	1	-1.58
23L	7.2000	0.497	4		0.06	0.70			7.2000	0.4967		4	3	0.12
60L	7.6250	0.556	4		0.25	0.78			7.6250	0.5560		4	3	0.55
44L	8.6250	1.391	4		0.71	1.96	II	Fail	8.6250	1.3913		4	3	1.55
13L	9.7500	0.957	4		1.23	1.35		Fail	9.7500	0.9574		4	3	2.67
25L	10.3333	0.577	3		1.50	0.81		Fail	10.3333	0.5774		3	2	3.26
Tot.gem	7.077	0.604 $\mu\text{g/kg}$		1%-level:	2.13	(1.97)			9	7.0766	()	9		8
Tot.std=	2.178	0.401		5%-level:	1.78	(1.67)								

**RESULTS:** Mean = **7.07661**  $\mu\text{g/kg}$

Repeatability variance **S2r = 0.56042**

Repeatability std. **Sr = 0.74861** --> 10.58% **r = 2.0961**

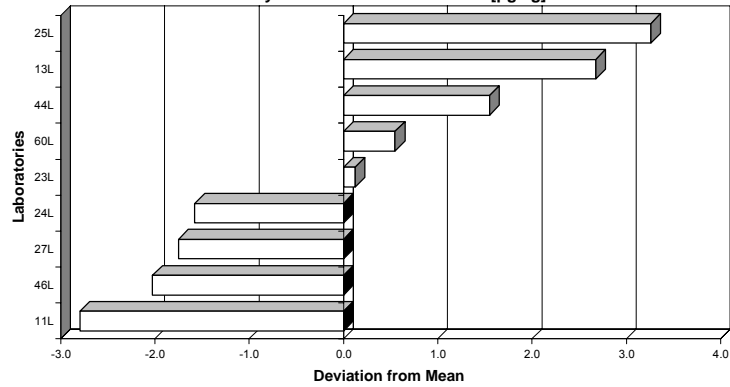
Between lab variance **S2L = 4.02390**

Reproducibility var. **S2R = 4.58432**

Reproducibility std. **SR = 2.14110** --> 30.26% **R = 5.9951**

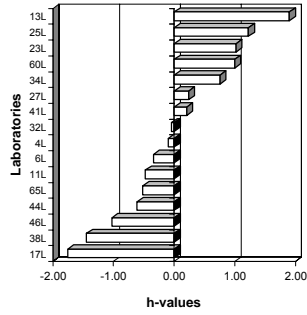
Remarks: none

**Soil 3 - Pyrene -- Mean PARM = 7.08 [ $\mu\text{g/kg}$ ]**

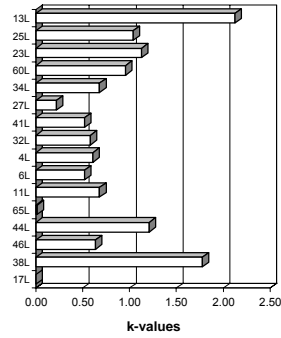


Sample: **Compost 1**  
 Element: **TOTAL PAH**

**Mandel's h statistics**  
 (Compost 1 - TOTAL PAH)



**Mandel's k statistics**  
 (Compost 1 - TOTAL PAH)



Unit: ug/kg

Mandel's k statistics (Compost 1 - TOTAL PAH)  
 Mandel's h statistics (Compost 1 - TOTAL PAH)  
 Compost 1 - TOTAL PAH -- Mean PARM = 3318 [ug/kg]

General calc.parm.  
 T1= 2.07057E+05  
 T2= 7.41009E+08  
 T3= 61  
 T4= 243  
 T5= 2.2831E+07  
 n= variabel  
 p= 16  
 N-table= 4

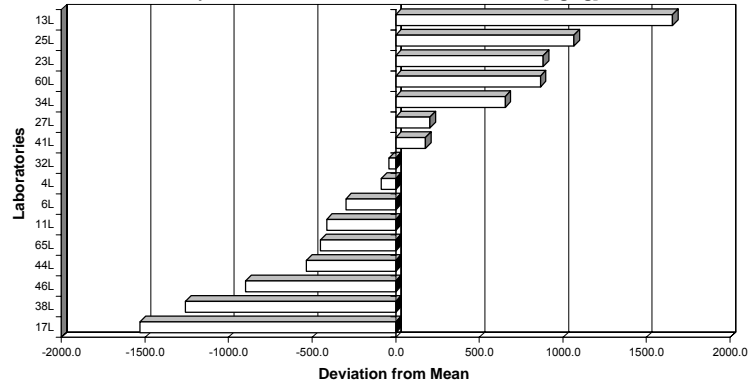
LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics		k-mark	k-mark > AvST+2std	AvX < AvST-2std	End Result:			
					h	k				PARM	Stdev	Rej.labs	N
17L	1788.1000	-	1	-1.76	-1.76				1788.1000	-	1	3	-1530.25
38L	2060.4000	1265.321	4	-1.44	1.78	I	Fail		2060.4000	1265.3212	4	3	-1257.95
46L	2420.9072	451.355	4	-1.03	0.63		Fail		2420.9072	451.3547	4	3	-897.44
44L	2784.2616	862.560	4	-0.61	1.21		Fail		2784.2616	862.5597	4	3	-534.09
65L	2869.1615	10.123	4	-0.52	0.01				2869.1615	10.1234	4	3	-449.19
11L	2904.5125	484.240	4	-0.47	0.68				2904.5125	484.2400	4	3	-413.83
6L	3020.0000	369.053	4	-0.34	0.52				3020.0000	369.0528	4	3	-298.35
4L	3231.6667	433.089	3	-0.10	0.61				3231.6667	433.0893	3	2	-86.68
32L	3279.2400	412.167	5	-0.04	0.58				3279.2400	412.1669	5	4	-39.11
41L	3497.2000	369.592	4	0.21	0.52				3497.2000	369.5917	4	3	178.85
27L	3522.9750	155.606	4	0.23	0.22				3522.9750	155.6063	4	3	204.63
34L	3972.6250	483.330	4	0.75	0.68				3972.6250	483.3302	4	3	654.28
60L	4183.7500	680.425	4	0.99	0.95		Fail		4183.7500	680.4251	4	3	865.40
23L	4202.0525	802.752	4	1.01	1.13		Fail		4202.0525	802.7516	4	3	883.71
25L	4384.2179	740.476	4	1.22	1.04		Fail		4384.2179	740.4761	4	3	1065.87
13L	4972.4834	1512.992	4	1.90	2.12	II	Fail		4972.4834	1512.9921	4	3	1654.14
Tot.gem	3318.347	602.205 ug/kg			2.33	(1.87)		16	3318.3471	( )	16	15	
Tot.std	871.392	394.289			1.86	(1.59)							

**RESULTS:** Mean = **3318.34708** ug/kg

Repeatability variance S2r = 507357.98368  
 Repeatability std. Sr = **712.29066** --> 21.47% r = 1994.4138  
 Between lab variance S2L = 536081.34276  
 Reproducibility var. S2R = 1043439.32644  
 Reproducibility std. SR = **1021.48878** --> 30.78% R = 2860.1686

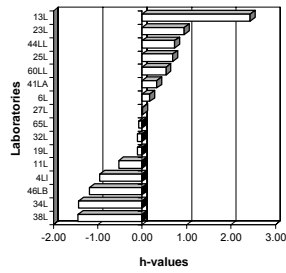
Remarks: none

**Compost 1 - TOTAL PAH -- Mean PARM = 3318 [ug/kg]**

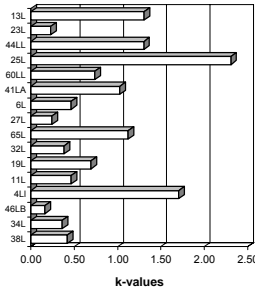


Sample: Sludge 1  
 Element: TOTAL PAH

Mandel's h statistics  
 (Sludge 1 - TOTAL PAH)



Mandel's k statistics  
 (Sludge 1 - TOTAL PAH)



Unit: ug/kg

Mandel's k statistics (Sludge 1 - TOTAL PAH)  
 Mandel's h statistics (Sludge 1 - TOTAL PAH)  
 Sludge 1 - TOTAL PAH -- Mean PARM = 12312 [ug/kg]

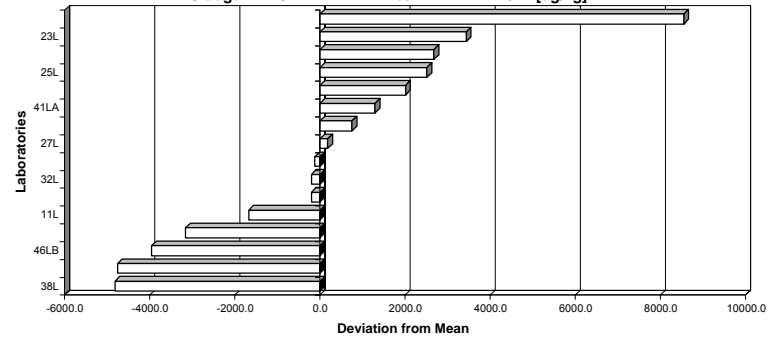
General calc.parm.  
 T1= 7.28089E+05  
 T2= 9.67234E+05  
 I3= 59  
 I4= 233  
 I5= 2.6937E+07  
 n= variabe 15  
 p= 4  
 N-table= 4

LAB	PARM-gem	Stdev	N	h-mark	Mandel's statistics	h	k	k-mark	4vX > AvST+2std	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
39L	7494.500C	388.486	4		-1.44	0.42			Fail		7494.5000	388.4864		4	3	-4817.64
34L	7556.342E	331.985	4		-1.42	0.36			Fail		7556.3425	331.9849		4	3	-4755.80
46LB	8357.319C	149.774	4		-1.19	0.16			Fail		8357.3190	149.7741		4	3	-3954.82
4LI	9155.000C	1568.747	4		-0.96	1.71	I		Fail		9155.0000	1568.7468		4	3	-3157.14
11L	10639.760C	428.221	3		-0.53	0.47			Fail		10639.7600	428.2212		3	2	-1672.38
19L	12107.075C	640.244	4		-0.10	0.70					12107.0750	640.2436		4	3	-205.07
32L	12110.500C	353.863	4		-0.10	0.38					12110.5000	353.8630		4	3	-201.64
65L	12194.898E	1032.452	4		-0.06	1.12					12194.8989	1032.4521		4	3	-117.28
27L	12492.250C	222.868	4		0.01	0.24					12492.2500	222.8682		4	3	180.11
6L	13064.000C	428.939	4		0.17	0.47					13064.0000	428.9390		4	3	751.86
41LA	13604.000C	942.056	4		0.33	1.02		Fail			13604.0000	942.0556		4	3	1291.86
60LL	14319.250C	661.027	4		0.54	0.74		Fail			14319.2500	661.0269		4	3	2007.11
29L	14925.750C	2118.592	4		0.98	2.30	II		Fail				25L			2513.61
44LL	14985.000C	1197.291	4		0.73	1.30		Fail			14985.0000	1197.2911		4	3	2672.86
23L	15746.750C	212.806	4		0.95	0.23		Fail			15746.7500	212.8057		4	3	3434.61
13L	20855.500C	1203.051	4	II	2.43	1.31		Fail			20855.5000	1203.0507		4	3	8543.36
Tot.gem	12469.241	743.775 ug/kg			2.33	(1.88)			15		12312.1404	(25L)		15	14	
Tot.std=	3449.415	558.406			1.86	(1.59)			1							

End Result:

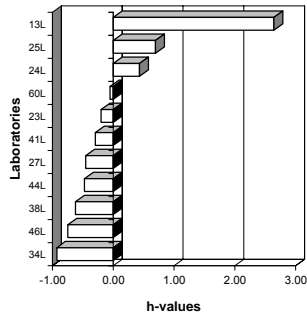
RESULTS: Mean = 12312.14036 ug/kg  
 Repeatability variance S2r = 612199.11268  
 Repeatability std. Sr = 782.43154 --> 6.35% r = 2190.8083  
 Between lab variance S2L = 12330405.47863  
 Reproducibility var. S2R = 12942604.59131  
 Reproducibility std. SR = 3597.58316 --> 29.22% R = 10073.2328  
 Remarks: 1 Lab rejected! (25L)

Sludge 1 - TOTAL PAH -- Mean PARM = 12312 [ug/kg]

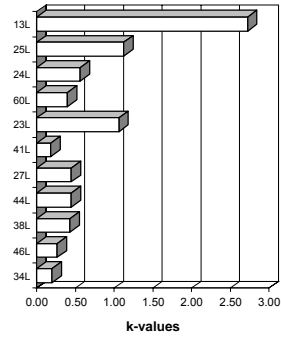


Sample: **Soil 3**  
 Element: **TOTAL PAH**

**Mandel's h statistics  
 (Soil 3 - TOTAL PAH)**



**Mandel's k statistics  
 (Soil 3 - TOTAL PAH)**



Unit: ug/kg

Mandel's k statistics (Soil 3 - TOTAL PAH)  
 Mandel's h statistics (Soil 3 - TOTAL PAH)  
 Soil 3 - TOTAL PAH -- Mean PARM = 44.52 [ug/kg]

General calc.parm.  
 T1= 1.53171E+03  
 T2= 8.04814E+04  
 T3= 35  
 T4= 129  
 T5= 2.6666E+03  
 n= variabel  
 p= 10  
 N-table= 4

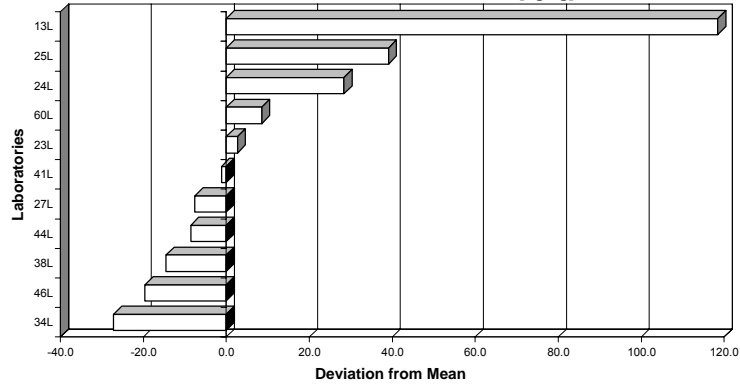
Mandel's statistics										End Result:				
LAB	PARM-gem	Stdev	N	h-mark	h	k	k-mark $\sqrt{x} > AvST+2std$	AvX < AvST-2std	PARM	Stdev	Rej.labs	N	N-1	dev_mean
34L	17.3500	3.313	4		-0.93	0.20		Fail	17.3500	3.3131		4	3	-27.17
46L	24.9026	4.327	4		-0.75	0.26		Fail	24.9026	4.3266		4	3	-19.62
38L	30.0000	7.071	2		-0.62	0.43		Fail	30.0000	7.0711		2	1	-14.52
44L	35.9500	7.389	4		-0.47	0.45		Fail	35.9500	7.3890		4	3	-5.57
27L	36.9500	7.442	4		-0.45	0.45			36.9500	7.4424		4	3	-7.57
41L	43.3333	3.055	3		-0.29	0.18			43.3333	3.0551		3	2	-1.19
23L	47.2000	17.578	4		-0.20	1.06			47.2000	17.5778		4	3	2.68
60L	53.0750	6.589	4		-0.05	0.40			53.0750	6.5886		4	3	8.56
24L	72.8500	9.263	2		0.43	0.56			72.8500	9.2631		2	1	28.33
25L	83.5750	18.582	4		0.69	1.12	!!	Fail	83.5750	18.5825		4	3	39.06
13L	163.0000	45.056	4	!!	2.64	2.72	!!	Fail	-	-	,13L	-	-	118.48
Tot.gem	55.290	11.788 ug/kg			1%-level:	2.22 (1.85)			10	44.5186		10	9	
Tot.std=	40.787	12.182			5%-level:	1.82 (1.58)			1					

**RESULTS:** Mean = **44.51860** ug/kg

Repeatability variance S2r = 106.66460  
 Repeatability std. Sr = **10.32786** --> 23.20% r = 28.9180  
 Between lab variance S2L = 398.82399  
 Reproducibility var. S2R = 505.48859  
 Reproducibility std. SR = **22.48307** --> 50.50% R = 62.9526

Remarks: 1 Lab rejected! (13L)

**Soil 3 - TOTAL PAH -- Mean PARM = 44.52 [ug/kg]**



**Annex 4:**

**Raw data submitted**



Sample: Compost 1 Element: Acenaphthene			Sample: Compost 1 Element: Acenaphthylene			Sample: Compost 1 Element: Anthracene			Sample: Compost 1 Element: Benz(a)anthracene			Sample: Compost 1 Element: benzo(a)pyrene			Sample: Element: LAB
LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB
13L	86.00		4L	32.00		4L	40.00		4L	360.00		4L	350.00		4L
13L	104.00		4L	35.00		4L	42.00		4L	390.00		4L	370.00		4L
13L	113.00		4L	32.00		4L	37.00		4L	330.00		4L	330.00		4L
13L	114.00		4L	35.00		4L	40.00		4L	380.00		4L	380.00		4L
27L	3.80		13L	414.00		65L	12.00		65L	271.00		65L	308.00		65L
27L	3.70		13L	852.00		65L	17.00		65L	281.00		65L	286.00		65L
27L	3.60		13L	317.00		65L	16.00		65L	265.00		65L	281.00		65L
27L	3.60		13L	358.00		65L	13.00		65L	247.00		65L	276.00		65L
23L	5.00		27L	2.10		13L	53.00		13L	488.00		13L	363.00		13L
23L	4.10		27L	2.30		13L	43.00		13L	570.00		13L	469.00		13L
23L	4.90		27L	2.10		13L	36.00		13L	568.00		13L	463.00		13L
23L	3.90		27L	2.10		13L	38.00		13L	585.00		13L	489.00		13L
44L	9.00		11L	15.49		34L	24.20		34L	274.60		34L	389.60		34L
44L	9.00		11L	14.78		34L	24.70		34L	287.00		34L	399.80		34L
32L	6.30		11L	15.45		34L	24.10		34L	377.30		34L	505.30		34L
32L	7.70		11L	12.63		34L	31.70		34L	467.90		34L	543.20		34L
32L	5.60		23L	13.00		41L	53.00		41L	425.00		41L	408.00		41L
60L	468.00		23L	17.00		41L	57.00		41L	466.00		41L	448.00		41L
60L	499.00		23L	20.00		41L	43.00		41L	466.00		41L	416.00		41L
60L	635.00		23L	16.00		41L	51.00		41L	613.00		41L	438.00		41L
60L	578.00		32L	15.00		27L	20.60		27L	328.60		27L	348.00		27L
46L	3.81		32L	76.00		27L	19.50		27L	345.10		27L	374.10		27L
46L	4.04		32L	23.00		27L	18.80		27L	318.60		27L	371.20		27L
46L	4.03		46L	16.06		27L	21.00		27L	355.20		27L	397.20		27L
46L	3.57		46L	15.55		11L	22.76		11L	298.74		11L	285.98		11L
			46L	19.88		11L	20.09		11L	311.98		11L	302.54		11L
						11L	22.02		11L	276.74		11L	231.00		11L
						11L	24.15		11L	328.22		11L	316.55		11L
						23L	30.00		23L	450.00		23L	370.00		23L
						23L	40.00		23L	520.00		23L	430.00		23L
						23L	40.00		23L	230.00		23L	440.00		23L
						23L	30.00		23L	440.00		23L	370.00		23L
						38L	13.00		38L	110.00		38L	45.00		38L
						38L	14.00		38L	120.00		38L	51.00		38L
						38L	13.00		38L	108.00		38L	45.00		38L
						38L	14.00		38L	130.00		38L	51.00		38L
						44L	26.00		44L	416.00		44L	374.00		44L
						44L	24.00		44L	458.00		44L	402.00		44L
						44L	26.00		44L	460.00		44L	418.00		44L
						44L	53.00		44L	470.00		44L	431.00		44L
						32L	28.00		32L	420.00		32L	380.00		60L
						32L	42.00		32L	580.00		32L	560.00		60L
						32L	34.00		32L	400.00		32L	340.00		60L
						32L	35.00		32L	480.00		32L	460.00		60L
						60L	31.00		60L	275.00		60L	345.00		6L
						60L	36.00		60L	299.00		60L	403.00		6L
						60L	27.00		60L	248.00		60L	306.00		6L
						60L	39.00		60L	393.00		60L	506.00		25L
						6L	50.00		6L	380.00		25L	372.00		25L
						6L	60.00		6L	410.00		25L	416.00		25L
						6L	50.00		6L	370.00		25L	342.00		25L
						25L	26.00		6L	410.00		25L	487.00		46L
						25L	31.00		25L	478.00		46L	310.00		46L
						25L	23.00		25L	560.00		46L	200.00		46L
						25L	25.00		25L	486.00		46L	230.00		46L
						46L	37.18		25L	593.00		46L	190.00		
						46L	32.67		46L	270.00		17L	430.00		
						46L	37.40		46L	190.00					
						46L	33.05		46L	180.00					
						17L	29.40		46L	150.00					



Compost 1 zo(b)fluoranthene		Sample: Element:	Compost 1 izo(ghi)perylene		Sample: Element:	Compost 1 zo(k)fluoranthene		Sample: Element:	Compost 1 Chryzene		Sample: Element:	Compost 1 izo(ah)anthracene		Sample: Element:	Compost 1 Fluoranthene	
PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]
560.00		4L	32.00		4L	210.00		4L	470.00		4L	85.00		4L	560.00	
600.00		4L	290.00		4L	230.00		4L	490.00		4L	92.00		65L	344.00	
540.00		4L	280.00		4L	210.00		4L	440.00		65L	66.00		65L	362.00	
610.00		4L	310.00		4L	240.00		4L	500.00		65L	73.00		65L	370.00	
465.00		65L	248.26		65L	204.00		65L	352.00		65L	67.00		65L	359.00	
450.00		65L	250.20		65L	197.00		65L	354.00		65L	61.00		13L	669.00	
465.00		65L	242.19		65L	204.00		65L	373.00		13L	103.00		13L	747.00	
433.00		65L	230.93		65L	190.00		65L	351.00		13L	131.00		34L	425.40	
431.00		13L	673.00		13L	205.00		13L	560.00		34L	23.60		34L	447.10	
489.00		13L	729.00		13L	271.00		13L	636.00		34L	28.90		34L	536.80	
411.00		13L	685.00		13L	260.00		13L	642.00		34L	57.70		34L	663.10	
459.00		13L	686.00		13L	266.00		13L	647.00		34L	59.20		27L	446.30	
426.90		34L	310.60		34L	185.40		34L	265.70		41L	50.00		27L	465.50	
474.50		34L	419.60		34L	217.10		34L	352.00		41L	63.00		27L	436.20	
575.60		34L	374.40		34L	267.60		34L	393.00		27L	72.30		27L	479.70	
622.10		34L	375.70		34L	285.10		34L	446.60		27L	80.80		11L	399.72	
561.00		41L	376.00		41L	178.00		41L	512.00		27L	80.10		11L	378.35	
573.00		41L	505.00		41L	188.00		41L	525.00		27L	85.10		11L	337.36	
571.00		41L	457.00		41L	238.00		41L	450.00		11L	50.43		11L	398.68	
677.00		41L	522.00		41L	278.00		41L	649.00		11L	56.38		23L	670.00	
528.30		27L	267.60		27L	213.80		27L	341.20		11L	55.13		23L	770.00	
621.80		27L	289.10		27L	222.80		27L	340.80		11L	57.37		23L	800.00	
609.10		27L	284.40		27L	212.60		27L	321.40		23L	76.00		23L	680.00	
645.70		27L	295.60		27L	233.40		27L	345.80		23L	89.00		38L	260.00	
333.27		11L	233.93		11L	182.68		11L	198.64		23L	87.00		38L	282.00	
358.48		11L	245.96		11L	201.94		11L	211.37		23L	75.00		32L	580.00	
331.08		11L	239.81		11L	245.38		11L	194.44		44L	63.00		32L	720.00	
355.92		11L	260.32		11L	201.53		11L	220.16		44L	65.00		32L	590.00	
590.00		23L	290.00		23L	250.00		23L	510.00		32L	100.00		32L	670.00	
660.00		23L	320.00		23L	300.00		23L	570.00		32L	130.00		60L	647.00	
710.00		23L	310.00		23L	280.00		23L	590.00		32L	90.00		60L	670.00	
600.00		23L	260.00		23L	260.00		23L	510.00		32L	110.00		6L	550.00	
530.00		38L	20.00		38L	20.00		38L	115.00		60L	36.00		6L	620.00	
560.00		38L	22.00		38L	34.00		38L	116.00		6L	120.00		6L	580.00	
640.00		38L	23.00		38L	41.00		38L	130.00		6L	130.00		6L	590.00	
720.00		44L	229.00		44L	213.00		38L	145.00		6L	130.00		25L	690.00	
472.00		44L	252.00		44L	233.00		44L	444.00		6L	120.00		25L	813.00	
533.00		44L	283.00		44L	237.00		44L	484.00		25L	61.00		46L	480.00	
572.00		44L	300.00		44L	239.00		44L	491.00		25L	67.00		46L	360.00	
584.00		32L	300.00		32L	280.00		44L	496.00		46L	72.31		46L	430.00	
399.00		32L	400.00		32L	380.00		60L	434.00		46L	50.00		46L	360.00	
456.00		32L	280.00		32L	260.00		60L	475.00		46L	54.62		17L	473.2	
369.00		32L	340.00		32L	320.00		60L	395.00		46L	49.86				
524.00		60L	441.00		60L	228.00		60L	568.00							
630.00		60L	472.00		60L	264.00		25L	594.00							
650.00		60L	402.00		60L	213.00		25L	682.00							
590.00		60L	540.00		60L	315.00		25L	598.00							
798.00		6L	310.00		6L	240.00		25L	709.00							
964.00		6L	320.00		6L	250.00		46L	420.00							
821.00		6L	290.00		6L	230.00		46L	310.00							
1094.00		6L	320.00		6L	270.00		46L	380.00							
390.00		25L	224.00		25L	226.00		46L	330.00							
250.00		25L	276.00		25L	269.00										
290.00		25L	228.00		25L	232.00										
240.00		25L	312.00		25L	302.00										
		46L	150.00		46L	240.00										
		46L	100.00		46L	170.00										
		46L	120.00		46L	150.06										
		46L	100.00		46L	130.00										
		17L	339.00													

## Raw data

## Compost 1

## PAH

Sample: Compost 1		[µg/kg]	Sample: Compost 1		[µg/kg]	Sample: Compost 1		[µg/kg]	Sample: Compost 1		[µg/kg]
Element: Fluorene	LAB PARM		Element: 1,2,3-cd)pyrene	LAB PARM		Element: Naphthalene	LAB PARM		Element: Phenantrene	LAB PARM	
4L	30.00		4L	290.00	4L	30.00	4L	95.00	4L	450.00	
13L	31.00		4L	310.00	13L	193.00	4L	110.00	4L	390.00	
13L	48.00		65L	220.00	13L	199.00	4L	93.00	4L	460.00	
41L	21.00		65L	223.00	34L	323.00	4L	98.00	65L	289.00	
41L	23.00		65L	218.00	34L	485.20	65L	65.00	65L	302.00	
27L	4.00		65L	204.00	34L	326.90	65L	70.00	65L	305.00	
27L	4.00		13L	411.00	34L	323.00	65L	73.00	65L	295.00	
27L	4.40		13L	447.00	41L	10.00	65L	68.00	13L	587.00	
27L	4.30		34L	397.70	27L	6.60	13L	172.00	13L	692.00	
11L	48.26		34L	323.00	27L	6.60	13L	196.00	13L	674.00	
11L	42.99		41L	178.00	27L	6.60	13L	185.00	13L	718.00	
11L	47.24		41L	205.00	27L	7.00	13L	193.00	34L	347.60	
11L	31.81		27L	286.10	23L	6.20	34L	73.10	34L	426.10	
23L	6.80		27L	319.80	23L	7.50	34L	81.40	34L	487.40	
23L	8.00		27L	311.50	23L	7.70	34L	77.10	34L	618.50	
23L	8.30		27L	325.00	23L	7.50	34L	99.20	41L	390.00	
23L	7.20		11L	213.83	38L	10.00	41L	108.00	41L	397.00	
44L	9.00		11L	227.89	44L	9.00	41L	115.00	41L	407.00	
32L	5.90		11L	213.80	46L	4.77	41L	85.00	41L	427.00	
32L	6.00		11L	234.80	46L	4.28	41L	118.00	27L	372.10	
32L	4.70		23L	320.00	46L	4.43	27L	90.00	27L	389.90	
60L	117.00		23L	350.00	46L	4.63	27L	98.00	27L	363.90	
60L	125.00		23L	350.00			27L	83.70	27L	402.50	
25L	4.00		23L	300.00			27L	92.40	11L	334.09	
46L	4.46		44L	343.00			11L	74.04	11L	316.58	
46L	4.42		44L	356.00			11L	67.36	11L	277.06	
46L	4.05		32L	390.00			11L	66.16	11L	323.73	
46L	3.43		32L	450.00			11L	75.57	23L	530.00	
			32L	360.00			23L	120.00	23L	610.00	
			32L	390.00			23L	150.00	23L	640.00	
			60L	243.00			23L	150.00	23L	540.00	
			60L	342.00			23L	120.00	38L	275.00	
			6L	310.00			38L	55.00	38L	280.00	
			6L	320.00			38L	60.00	38L	250.00	
			6L	290.00			38L	60.00	38L	260.00	
			6L	330.00			38L	70.00	44L	379.00	
			25L	377.00			44L	125.00	44L	426.00	
			25L	431.00			44L	156.00	44L	431.00	
			46L	170.00			44L	136.00	44L	435.00	
			46L	120.00			44L	154.00	32L	490.00	
			46L	139.80			32L	100.00	32L	620.00	
			46L	120.00			32L	130.00	32L	500.00	
							32L	110.00	32L	550.00	
							32L	120.00	60L	579.00	
							60L	139.00	60L	594.00	
							60L	142.00	60L	493.00	
							60L	115.00	60L	776.00	
							60L	134.00	6L	430.00	
							6L	110.00	6L	470.00	
							6L	140.00	6L	440.00	
							6L	110.00	6L	460.00	
							25L	130.00	25L	534.00	
							25L	131.00	25L	591.00	
							25L	131.00	25L	569.00	
							25L	133.00	25L	687.00	
							46L	79.03	46L	410.00	
							46L	66.25	46L	310.00	
							46L	76.62	46L	310.00	
							46L	62.29	46L	260.00	
							17L	95.60	17L	420.90	

Horizontal validation

Sample: Sludge 1 Element: <i>1</i> cenaphthene			Sample: Sludge 1 Element: <i>1</i> cenaphthylene			Sample: Sludge 1 Element: Anthracene			Sample: Sludge 1 Element: <i>nz(a)anthracene</i>			Sample: Sludge 1 Element: <i>enzo(a)pyrene</i>			Sample: Element:
LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB	PARM	[µg/kg]	LAB
65L	63.00		13L	2256.00		4L	160.00		4L	690.00		4L	190.00		4L
65L	66.00		13L	2451.00		4L	180.00		4L	880.00		4L	330.00		4L
65L	64.00		13L	1588.00		4L	150.00		4L	780.00		4L	150.00		4L
65L	83.00		13L	1965.00		4L	200.00		4L	920.00		4L	230.00		4L
13L	238.00		27L	22.00		65L	135.00		65L	875.00		65L	834.00		65L
13L	252.00		27L	20.00		65L	142.00		65L	885.00		65L	833.00		65L
13L	254.00		27L	20.00		65L	139.00		65L	907.00		65L	868.00		65L
13L	325.00		27L	20.00		65L	165.00		65L	1176.00		65L	1065.00		65L
34L	40.30		11L	56.03		13L	419.00		13L	1378.00		13L	1005.00		13L
34L	43.70		11L	48.32		13L	476.00		13L	1383.00		13L	1146.00		13L
34L	39.20		11L	68.93		13L	373.00		13L	1362.00		13L	1075.00		13L
34L	39.90		11L	69.00		13L	455.00		13L	1379.00		13L	1225.00		13L
27L	77.00		23L	34.00		34L	153.80		41L	867.00		34L	769.20		34L
27L	72.00		23L	42.00		34L	165.90		41L	912.00		34L	780.20		34L
27L	67.00		23L	40.00		34L	155.10		41L	1270.00		34L	728.60		34L
27L	69.00		23L	41.00		34L	156.60		41L	1370.00		34L	739.80		34L
11L	108.23		44L	30.00		41L	416.00		27L	1075.00		41L	1100.00		41L
11L	131.80		44L	100.00		41L	457.00		27L	912.00		41L	1120.00		41L
11L	140.43		32L	2.00		41L	412.00		27L	929.00		41L	1070.00		41L
23L	150.00		32L	38.00		41L	467.00		27L	872.00		41L	1200.00		41L
23L	140.00		32L	39.00		27L	155.00		11L	794.03		27L	1066.00		27L
23L	140.00		32L	53.00		27L	146.00		11L	779.96		27L	1028.00		27L
23L	140.00		24L	2.00		27L	142.00		11L	761.24		27L	1023.00		27L
38L	50.00		24L	1.00		27L	136.00		23L	1240.00		27L	988.00		27L
38L	60.00		46L	30.04		11L	128.02		23L	1240.00		11L	790.34		11L
38L	50.00		46L	33.02		11L	130.12		23L	1180.00		11L	774.03		11L
38L	60.00		46L	44.35		11L	126.22		23L	1260.00		11L	744.65		11L
44L	207.00		46L	47.29		11L	128.00		38L	670.00		23L	1100.00		23L
44L	269.00		19L	16.60		23L	340.00		38L	736.00		23L	1170.00		23L
44L	195.00		19L	12.70		23L	300.00		38L	780.00		23L	1110.00		23L
44L	200.00		19L	12.10		23L	320.00		38L	800.00		23L	1170.00		23L
32L	100.00		19L	13.40		23L	330.00		44L	1096.00		38L	450.00		38L
32L	120.00					38L	149.00		44L	1425.00		38L	480.00		38L
32L	100.00					38L	150.00		44L	1271.00		38L	546.00		38L
32L	120.00					38L	150.00		44L	1295.00		38L	550.00		38L
60L	478.00					38L	161.00		32L	1200.00		44L	1085.00		44L
60L	461.00					44L	245.00		32L	1000.00		44L	1387.00		44L
60L	599.00					44L	286.00		32L	1200.00		44L	1312.00		44L
60L	554.00					44L	258.00		32L	1000.00		44L	1323.00		44L
6L	80.00					44L	269.00		60L	1543.00		32L	930.00		60L
6L	90.00					32L	250.00		60L	1650.00		32L	830.00		60L
6L	80.00					32L	250.00		60L	1083.00		32L	920.00		60L
24L	2.00					32L	240.00		60L	1669.00		32L	860.00		60L
24L	1.60					32L	260.00		6L	870.00		60L	780.00		6L
46L	69.91					60L	212.00		6L	900.00		60L	820.00		6L
46L	61.83					60L	250.00		6L	900.00		60L	780.00		6L
46L	68.85					60L	225.00		6L	920.00		60L	820.00		6L
46L	74.01					60L	238.00		24L	536.30		6L	751.00		24L
19L	50.00					6L	290.00		24L	483.00		6L	941.00		24L
19L	60.00					6L	310.00		25L	854.00		6L	1042.00		25L
19L	60.00					6L	290.00		25L	1098.00		6L	1182.00		25L
19L	70.00					6L	300.00		25L	1138.00		24L	304.40		25L
						24L	130.50		25L	1278.00		24L	267.60		25L
						24L	127.20		46L	480.00		46L	540.00		46L
						25L	238.00		46L	490.00		46L	560.00		46L
						25L	329.00		46L	480.00		46L	540.00		46L
						25L	320.00		19L	520.00		46L	580.00		46L
						25L	329.00		19L	950.00		19L	840.00		19L
						46L	160.00		19L	900.00		19L	850.00		19L
						46L	140.00		19L	990.00		19L	820.00		19L
						46L	170.00					19L	890.00		19L
						46L	180.00					17L	912.00		19L
						19L	160.00								
						19L	170.00								
						19L	160.00								
						19L	180.00								
						17L	201.00								

Sludge 1 zo(b)fluoranthene		Sample: Sludge 1 Element: izo(g(h))perylene		Sample: Sludge 1 Element: zo(k)fluoranthene		Sample: Sludge 1 Element: Chryzene		Sample: Sludge 1 Element: izo(a(h))anthracene		Sample: Sludge 1 Element: Fluoranthene	
PARM	[µg/kg]	LAB	PARM	LAB	PARM	LAB	PARM	LAB	PARM	LAB	PARM
450.00		4L	250.00	65L	654.00	4L	900.00	4L	1100.00	4L	2000.00
860.00		4L	650.00	65L	657.00	4L	1200.00	4L	1800.00	4L	2200.00
480.00		4L	340.00	65L	678.00	4L	1000.00	4L	100.00	4L	2100.00
830.00		4L	480.00	65L	783.00	4L	1300.00	4L	120.00	4L	2300.00
1491.00		65L	693.81	13L	621.00	65L	1291.00	65L	230.00	65L	2006.00
1497.00		65L	705.01	13L	665.00	65L	1300.00	65L	236.00	65L	1998.00
1544.00		65L	713.80	13L	644.00	65L	1304.00	65L	239.00	65L	2079.00
1784.00		65L	833.02	13L	676.00	65L	1414.00	65L	279.00	65L	2400.00
1219.00		13L	1136.00	34L	453.60	13L	1340.00	13L	209.00	13L	2949.00
1322.00		13L	1170.00	34L	461.80	13L	1490.00	13L	298.00	13L	3232.00
1355.00		13L	992.00	34L	439.20	13L	1287.00	13L	203.00	13L	2951.00
1625.00		13L	1087.00	34L	446.90	13L	1379.00	13L	341.00	13L	3057.00
1143.00		41L	1130.00	41L	573.00	34L	734.20	34L	78.00	34L	2237.10
1192.00		41L	1430.00	41L	597.00	34L	810.80	34L	80.60	34L	2411.50
1095.40		41L	1110.00	41L	604.00	34L	694.20	34L	75.70	34L	2089.30
1116.70		41L	1340.00	41L	667.00	34L	121.70	34L	75.80	34L	2223.50
1150.00		27L	764.00	27L	637.00	41L	1010.00	41L	144.00	41L	2310.00
1170.00		27L	736.00	27L	590.00	41L	1060.00	41L	154.00	41L	2370.00
1270.00		27L	696.00	27L	578.00	41L	1100.00	41L	158.00	41L	2400.00
1280.00		27L	715.00	27L	581.00	41L	1150.00	27L	221.00	41L	2630.00
2037.00		11L	967.63	11L	928.38	27L	1069.00	27L	211.00	27L	2308.00
1949.00		11L	776.39	11L	816.74	27L	1005.00	27L	212.00	27L	2230.00
1966.00		11L	763.77	11L	875.50	27L	984.00	27L	206.00	27L	2250.00
1927.00		23L	740.00	23L	650.00	27L	990.00	11L	280.35	27L	2217.00
1074.94		23L	790.00	23L	650.00	11L	975.21	11L	271.47	11L	1812.71
1060.57		23L	780.00	23L	670.00	11L	942.45	11L	239.79	11L	1741.01
1010.41		23L	780.00	23L	670.00	11L	911.53	23L	240.00	11L	1619.79
1720.00		38L	385.00	38L	307.00	23L	1360.00	23L	270.00	23L	2980.00
1730.00		38L	447.00	38L	326.00	23L	1430.00	23L	250.00	23L	2880.00
1890.00		38L	450.00	38L	350.00	23L	1350.00	23L	240.00	23L	2960.00
1910.00		38L	533.00	38L	389.00	23L	1360.00	38L	70.00	23L	3010.00
712.00		44L	536.00	44L	569.00	38L	358.00	38L	80.00	38L	1700.00
844.00		44L	685.00	44L	740.00	38L	410.00	38L	88.00	38L	1880.00
950.00		44L	629.00	44L	685.00	38L	390.00	38L	90.00	38L	1850.00
1070.00		44L	634.00	44L	695.00	38L	400.00	44L	216.00	38L	1900.00
1340.00		32L	630.00	32L	730.00	44L	1231.00	44L	266.00	44L	2701.00
1712.00		32L	640.00	32L	730.00	44L	1550.00	44L	244.00	44L	3282.00
1595.00		32L	630.00	32L	750.00	44L	1403.00	44L	257.00	44L	2917.00
1625.00		32L	670.00	32L	780.00	44L	1448.00	32L	290.00	44L	3029.00
1198.00		60L	971.00	60L	608.00	60L	1292.00	32L	290.00	32L	2900.00
1260.00		60L	1020.00	60L	643.00	60L	1398.00	32L	280.00	32L	2900.00
1200.00		60L	1018.00	60L	620.00	60L	1327.00	32L	300.00	32L	2800.00
1323.00		60L	1048.00	60L	654.00	60L	1398.00	60L	100.00	32L	2800.00
1890.00		6L	700.00	6L	510.00	6L	970.00	60L	104.00	60L	2567.00
1900.00		6L	720.00	6L	560.00	6L	990.00	60L	91.00	60L	2723.00
1930.00		6L	680.00	6L	470.00	6L	1000.00	60L	106.00	60L	2608.00
1940.00		6L	730.00	6L	540.00	6L	1130.00	6L	320.00	60L	2655.00
916.90		24L	333.00	24L	157.10	24L	728.80	6L	310.00	6L	2290.00
957.10		24L	388.00	24L	141.30	24L	803.00	6L	350.00	6L	2740.00
1884.00		25L	508.00	25L	515.00	25L	1150.00	25L	141.00	6L	2490.00
2367.00		25L	642.00	25L	646.00	25L	1500.00	25L	170.00	6L	2640.00
2490.00		25L	654.00	25L	697.00	25L	1554.00	25L	178.00	25L	2341.00
2800.00		25L	726.00	25L	779.00	25L	1687.00	25L	192.00	25L	3004.00
540.00		46L	330.00	46L	430.00	46L	770.00	46L	120.00	25L	3140.00
490.00		46L	290.00	46L	470.00	46L	840.00	46L	130.00	25L	3410.00
500.00		46L	260.00	46L	660.00	46L	770.00	46L	120.00	46L	2200.00
440.00		46L	300.00	46L	510.00	46L	990.00	46L	130.00	46L	2300.00
1220.00		19L	800.00	19L	640.00	19L	1440.00	19L	170.00	46L	2200.00
1260.00		19L	740.00	19L	610.00	19L	1460.00	19L	160.00	46L	2300.00
1200.00		19L	720.00	19L	600.00	19L	1390.00	19L	150.00	19L	2280.00
1340.00		19L	850.00	19L	690.00	19L	1490.00	19L	190.00	19L	2080.00
		17L	777.00							19L	2190.00
										19L	2520.00
										17L	2078.00

Sample: Sludge 1		Sample: Sludge 1		Sample: Sludge 1		Sample: Sludge 1		Sample: Sludge 1	
Element: Fluorene		Element: 1,2,3-cdpyrene		Element: Naphthalene		Element: Phenantrene		Element: Pyrene	
[µg/kg]		[µg/kg]		[µg/kg]		[µg/kg]		[µg/kg]	
LAB	PARM	LAB	PARM	LAB	PARM	LAB	PARM	LAB	PARM
4L	140.00	4L	410.00	4L	10.00	4L	990.00	4L	1400.00
4L	150.00	4L	620.00	4L	10.00	4L	1100.00	4L	1500.00
4L	140.00	4L	360.00	65L	81.00	4L	1100.00	4L	1400.00
65L	134.00	4L	470.00	65L	83.00	65L	993.00	4L	1500.00
65L	133.00	65L	640.00	65L	86.00	65L	1004.00	65L	1425.00
65L	132.00	65L	650.00	65L	80.00	65L	1017.00	65L	1418.00
65L	123.00	65L	663.00	13L	2037.00	65L	1047.00	65L	1467.00
13L	217.00	65L	762.00	13L	2041.00	13L	1865.00	65L	1732.00
13L	224.00	13L	1061.00	13L	1971.00	13L	1944.00	13L	2315.00
13L	189.00	13L	1170.00	13L	2470.00	13L	1810.00	13L	2534.00
13L	190.00	13L	957.00	34L	64.20	13L	1967.00	13L	2435.00
34L	171.90	13L	1142.00	34L	72.30	34L	852.50	13L	2630.00
34L	188.30	34L	880.60	34L	49.07	34L	900.30	41L	934.00
34L	170.00	34L	889.40	34L	59.10	34L	830.80	41L	943.00
34L	174.20	34L	837.70	41L	977.00	34L	848.20	41L	1040.00
41L	412.00	34L	843.50	41L	1020.00	41L	1350.00	41L	1130.00
41L	463.00	41L	412.00	41L	485.00	41L	1370.00	27L	1589.00
41L	427.00	41L	446.00	41L	952.00	41L	1390.00	27L	1539.00
41L	471.00	41L	438.00	27L	101.00	41L	1570.00	27L	1540.00
27L	149.00	41L	502.00	27L	96.00	27L	125.00	27L	1537.00
27L	139.00	27L	822.00	27L	93.00	27L	1254.00	11L	1346.66
27L	142.00	27L	818.00	27L	95.00	27L	1211.00	11L	1262.25
27L	137.00	27L	718.00	11L	45.60	27L	1179.00	11L	1186.68
11L	211.25	27L	767.00	11L	42.50	11L	773.04	23L	2090.00
11L	204.98	11L	863.70	11L	42.07	11L	796.89	23L	2090.00
11L	207.79	11L	782.72	23L	110.00	11L	757.54	23L	2100.00
23L	270.00	11L	744.42	23L	120.00	11L	772.00	23L	2110.00
23L	260.00	23L	850.00	23L	110.00	23L	1700.00	38L	1460.00
23L	280.00	23L	880.00	23L	120.00	23L	1640.00	38L	1500.00
23L	280.00	23L	890.00	38L	79.00	23L	1660.00	38L	1380.00
38L	130.00	23L	910.00	38L	80.00	23L	1720.00	38L	1430.00
38L	141.00	38L	280.00	38L	75.00	38L	940.00	44L	1392.00
38L	123.00	38L	310.00	38L	80.00	38L	956.00	44L	1659.00
38L	130.00	38L	250.00	44L	61.00	38L	945.00	44L	1551.00
44L	193.00	38L	310.00	44L	68.00	38L	956.00	44L	1564.00
44L	227.00	44L	1134.00	44L	78.00	44L	1392.00	32L	2100.00
44L	210.00	44L	1191.00	44L	101.00	44L	1940.00	32L	2100.00
44L	217.00	44L	1115.00	32L	570.00	44L	1484.00	32L	2000.00
32L	230.00	44L	1134.00	32L	290.00	44L	1515.00	32L	2000.00
32L	220.00	32L	1200.00	32L	200.00	32L	1500.00	60L	2178.00
32L	210.00	32L	1000.00	32L	290.00	32L	1600.00	60L	2362.00
32L	220.00	32L	980.00	6L	100.00	32L	1500.00	60L	2500.00
60L	155.00	32L	1000.00	6L	100.00	32L	1600.00	60L	2355.00
60L	180.00	60L	600.00	6L	100.00	60L	1330.00	6L	1550.00
60L	166.00	60L	788.00	24L	44.70	60L	1542.00	6L	1660.00
60L	174.00	6L	730.00	24L	58.30	60L	1394.00	6L	1700.00
6L	200.00	6L	760.00	46L	78.00	60L	1459.00	6L	1760.00
6L	170.00	6L	700.00	46L	89.34	6L	1200.00	24L	734.30
6L	190.00	6L	760.00	46L	95.53	6L	1280.00	24L	676.00
24L	90.00	25L	929.00	46L	100.00	6L	1190.00	25L	1743.00
24L	90.50	25L	1179.00	19L	101.00	6L	1360.00	25L	2085.00
25L	277.00	25L	1205.00	19L	98.80	24L	632.60	25L	2125.00
25L	290.00	25L	1314.00	19L	99.70	24L	596.60	25L	2407.00
25L	250.00	46L	410.00	19L	104.00	25L	1315.00	46L	1100.00
25L	258.00	46L	460.00			25L	1695.00	46L	1100.00
46L	140.00	46L	440.00			25L	1723.00	46L	1000.00
46L	140.00	46L	410.00			25L	1749.00	46L	1200.00
46L	140.00	19L	810.00			46L	960.16	19L	1390.00
46L	140.00	19L	750.00			46L	930.00	19L	1490.00
19L	170.00	19L	760.00			46L	920.00	19L	1460.00
19L	170.00	19L	860.00			46L	940.00	19L	1570.00
19L	140.00					19L	1080.00	17L	1567.00
19L	180.00					19L	1050.00		
						19L	1110.00		
						19L	1120.00		
						17L	1158.00		

Sample:	Soil 3		Sample:	Soil 3		Sample:	Soil 3		Sample:	Soil 3		Sample:	Soil 3		Sample:	Soil 3	
Element:	1acenaphthene		Element:	cenaphthylene		Element:	Anthracene		Element:	nz(a)anthracene		Element:	lenzo(a)pyrene		Element:	zo(b)fluoranthene	
	LAB	PARM		LAB	PARM		LAB	PARM		LAB	PARM		LAB	PARM		LAB	PARM
	13L	20.00	[µg/kg]	13L	6.00		13L	2.00		11L	3.480		13L	2.00		13L	2.00
	13L	30.00		13L	9.00		13L	3.00		13L	7.000		13L	3.00		13L	3.00
	13L	20.00		13L	6.00		13L	3.00		13L	6.000		13L	2.00		13L	2.00
	13L	30.00		13L	9.00		13L	2.00		13L	6.000		13L	3.00		23L	2.60
	23L	1.30		24L	25.40		23L	1.90		13L	6.000		23L	1.90		23L	2.70
	23L	1.10		24L	30.00		23L	1.60		25L	2.000		23L	1.80		23L	2.40
	23L	1.10		27L	1.20		23L	2.10		25L	3.000		23L	2.10		23L	2.30
	23L	1.30		27L	1.20		23L	1.30		25L	1.000		23L	2.10		25L	30.00
	24L	23.60		27L	1.20		38L	5.00		25L	1.000		25L	0.20		25L	50.00
	24L	23.00		27L	1.20		38L	5.00		27L	1.900		25L	0.10		25L	30.00
	27L	11.00		46L	0.76		41L	20.00		27L	1.800		25L	1.00		25L	70.00
	34L	16.30		46L	0.68		41L	23.00		27L	1.600		25L	2.00		27L	4.80
	34L	16.60		46L	0.76		41L	20.00		27L	1.900		27L	1.90		27L	4.40
	34L	14.40		46L	0.79		44L	1.5		41L	20.000		27L	1.70		27L	4.50
	34L	17.10					44L	1.6		41L	21.000		27L	1.80		27L	4.30
	46L	0.66					44L	1.7		41L	26.000		27L	1.70		38L	5.00
	46L	0.78					44L	2.1		44L	1.800		38L	5.00		38L	5.00
	46L	0.61					46L	0.35		44L	2.300		38L	5.00		44L	3.00
	60L	14.30					46L	0.69		44L	3.000		46L	2.43		44L	3.30
	60L	16.00					46L	0.42		46L	1.065		46L	2.22		44L	4.50
	60L	11.30					46L	0.10		46L	1.003		46L	1.82		44L	5.10
	60L	12.00					60L	1.50		46L	1.089		46L	0.70		46L	2.21
							60L	1.60		46L	0.718		60L	3.60		46L	1.39
										60L	2.900		60L	4.00		46L	1.66
										60L	3.200		60L	2.80		46L	1.34
										60L	2.300		60L	3.00		60L	6.20
																60L	7.00
																60L	6.90
																60L	7.20

Soil 3		Sample: Soil 3		Sample: Soil 3		Sample: Soil 3		Sample: Soil 3		Sample: Soil 3		Sample: Soil 3	
zo(ghi)perylene		zo(k)fluorethene		Chryzene		zo(ah)anthracene		Fluoranthene		Fluorene		zo(1,2,3-cd)py	
PARM	[µg/kg]	LAB	PARM	LAB	PARM	LAB	PARM	LAB	PARM	LAB	PARM	LAB	PARM
1.90		13L	2.00	11L	2.20	44L	3.50	13L	1.00	13L	13.00	23L	1.40
2.20		13L	3.00	11L	4.00	44L	3.70	13L	2.00	13L	14.00	23L	1.30
1.90		13L	2.00	23L	1.00	44L	0.40	13L	1.00	13L	18.00	23L	1.40
1.60		23L	1.10	23L	1.20	44L	0.70	13L	2.00	13L	21.00	23L	1.30
3.60		23L	1.20	23L	1.00			23L	4.40	23L	1.80	25L	2.00
3.20		25L	0.50	25L	5.00			23L	4.60	23L	1.70	25L	3.00
3.10		25L	1.00	25L	7.00			23L	4.00	23L	2.00	25L	3.00
3.70		27L	1.20	25L	6.00			23L	4.40	23L	1.80	25L	5.00
1.25		27L	0.90	25L	7.00			24L	3.60	24L	12.00	27L	2.80
1.34		27L	0.90	27L	2.30			24L	4.30	24L	1.60	27L	2.50
1.14		27L	1.20	27L	2.20			25L	6.00	44L	1.7	27L	2.40
1.01		38L	5.00	27L	2.10			25L	7.00	44L	1.8	27L	2.60
		38L	5.00	44L	3.20			25L	7.00	44L	2.1	46L	1.54
		44L	0.90	44L	3.40			25L	8.00	46L	1.01	46L	1.44
		44L	1.60	44L	4.60			27L	3.40	46L	0.97	46L	1.46
		46L	1.60	46L	2.45			27L	3.30	46L	1.03	46L	1.28
		46L	0.79	46L	2.15			27L	3.30	46L	0.82		
		46L	0.75	46L	2.21			27L	3.10	60L	2.40		
		46L	0.53	46L	1.82			38L	5.00	60L	2.50		
		60L	0.90	60L	2.50			38L	10.00	60L	2.60		
		60L	1.10	60L	2.80			44L	5.9	60L	2.80		
		60L	0.90	60L	2.00			44L	6.1				
		60L	1.00	60L	2.10			44L	7.5				
								44L	7.7				
								46L	3.52				
								46L	3.37				
								46L	3.41				
								46L	2.57				
								60L	5.70				
								60L	6.40				
								60L	4.50				
								60L	4.80				

Pyrene [µg/kg]	Sample: Soil 3		[µg/kg]	Sample: Soil 3		[µg/kg]	Sample: Soil 3		[µg/kg]
	Element: Naphthalene			Element: Phenanthrene			Element: Pyrene		
	LAB	PARM		LAB	PARM		LAB	PARM	
13L	25.00		13L	24.00		11L	4.28		
13L	82.00		13L	31.00		13L	10.00		
13L	37.00		13L	28.00		13L	9.00		
13L	90.00		13L	35.00		13L	11.00		
23L	3.40		23L	4.60		13L	9.00		
23L	3.00		23L	4.70		23L	6.90		
23L	2.80		23L	4.40		23L	7.90		
23L	3.10		23L	4.30		23L	6.80		
24L	22.60		24L	12.00		23L	7.20		
24L	20.90		24L	11.10		24L	5.60		
27L	4.00		25L	11.00		24L	5.40		
27L	2.90		25L	13.00		25L	10.00		
27L	3.10		25L	11.00		25L	10.00		
27L	3.30		25L	12.00		25L	11.00		
46L	1.60		27L	4.50		27L	5.50		
46L	1.80		27L	4.30		27L	5.30		
			27L	4.20		27L	5.00		
			27L	4.30		27L	5.50		
			38L	5.00		44L	7.00		
			38L	5.00		44L	8.00		
			44L	7.00		44L	9.40		
			44L	8.70		44L	10.10		
			44L	8.90		46L	5.01		
			46L	3.22		46L	5.22		
			46L	3.10		46L	5.55		
			46L	3.28		46L	4.41		
			46L	2.68		60L	7.40		
			60L	7.80		60L	8.30		
			60L	8.50		60L	7.00		
			60L	8.50		60L	7.80		
			60L	8.60					



European Commission

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**Abstract**

Project HORIZONTAL is interdisciplinary aiming at a harmonisation and horizontal standardisation of test procedures, in particular for sludge, soils and biowastes. In the context of this standardization project, a series of draft technical specifications were designed upon an extensive desk study, fine-tuned after expert consultations and finally validated in international intercomparisons exercise.

This report summarises the work performed within the validation study of the draft standard for the determination of polyaromatic hydrocarbons in soils, sludge and treated bio-waste using GC and HPLC. It further explains the underlying statistical concept for the calculation of reproducibility and repeatability from intercomparisons data. In addition all single values, results of the statistical evaluation as well as background information on the validation materials used are described and explained.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

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