COMMISSION OF THE EUROPEAN COMMUNITIES

environment and quality of life

A EUROPEAN COMMUNITY STUDY ON THE DETERMINATION OF CYANIDES, PHENOLS AND HYDROCARBONS IN SURFACE WATER

Report of a Working Group of Experts

Directorate-General
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Report of a Working Group of Experts

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CONTENTS

1. Introduction

The Commission of the European Communities, Health Protection Directorate, Luxembourg, in January 1974, suggested a collaborative study in the working group 'Relatively unstable organic compounds' to detect free cyanides, phenols and hydrocarbons in surface water. For this no single method was to be used, but different methods chosen by the participants were to be tested for comparability of the results. The aim of this work was a preliminary experiment for quality control of analytic measurement rather than a collaborative study with a standard procedure, so that the information from the European Community relating to environmental pollution by these above mentioned compounds (see H. Mühleck: Occurence of Phenols and Hydrocarbons in the Environment; report EC, Luxembourg, in press) could be evaluated. The Health Protection Directorate collaborated with the Environment and Consumer Protection Service in this study and in April 1974 the preliminary plans were discussed between them and the Institut für Wasser-, Boden- und Lufthygiene des Bundesgesundheitsamtes, Berlin. An explanatory note (see appendix 10.1) was sent to interested laboratories. Thirtyfour laboratories from different European countries expressed their interest (Fig. 9.1).

The schedule was revised:

1. Delivery of the samples by 13th August, 1974
2. Results sent back by 5th October, 1974
3. A meeting of the participating laboratories in Luxembourg on the 4th - 5th November, 1974, for a final discussion

2. Technical details

Technical details were as follows:

The water samples were to be examined for their content of free cyanides, phenols and hydrocarbons by any chosen method, and to ensure that enough sample material was available, for those methods not known to us to begin with, 3 samples (each 2 litres) of A, of B and of C were provided. For shipping purposes 2-litre red wine bottles seemed appropriate. Preliminary studies showed that the samples were not affected by absorption by the corks or by the glass. The absorption was less than 1 % (see 3.1.).

As basic material a heavily polluted 'surface water' was chosen, so that the analytical quality control was carried out under conditions approximately corresponding to those met while monitoring surface or waste water.

The samples were prepared in the following way: 700 litres of surface water were taken from a 'river' and kept in a fiberglass container for 12 hours to allow the main part of the suspended matter to settle. 550 litres of the supernatant sludge water were pumped into a second tank, diluted with 250 litres of tap water and adjusted to pH 11 with NaOH to stabilize the sample. Most of the calcium and magnesium salts precipitated from the surface water were removed by filtering twice through gravel filters. The remainder precipitated during transportation.

Samples A and B were bottled from this solution and not taken from two different surface waters, as originally intended. The identity of A and B was an additional advantage for statistical evaluation, because the individual values of samples A and B

could be compared with each other.

Sample C was prepared from 250 litres of the original sample material adding the following compounds:

(1) Potassium cyanide to a final concentration of 3.9 mg CN^- per litre sample
(2) 2,6 - dichlorophenol to a final concentration of 1 mg phenol per litre sample
(3) octahydrophenanthrene to a final concentration of 1 mg C per litre sample

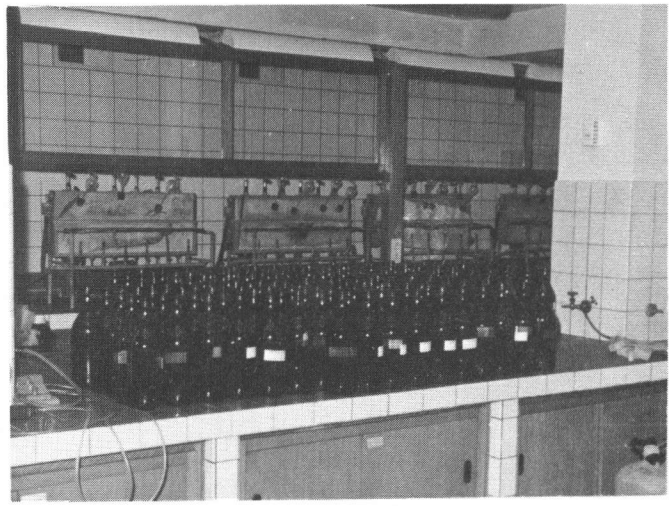
After these additions and five hours of intensive mixing sample C was bottled.

The finished samples were air-freighted to the participating laboratories on the 30th of August, 1974. Minimum-maximum recording thermometers were packed in the shipping boxes because temperature variations were expected; thus a higher temperature during shipment could be determined. This showed the highest temperatures occurred not only on the transportation south to Italy but also to the middle of Europe (all Belgian and one French laboratory). In most other cases the measured maximum temperature remained below 30° C. (Table 8.1.).

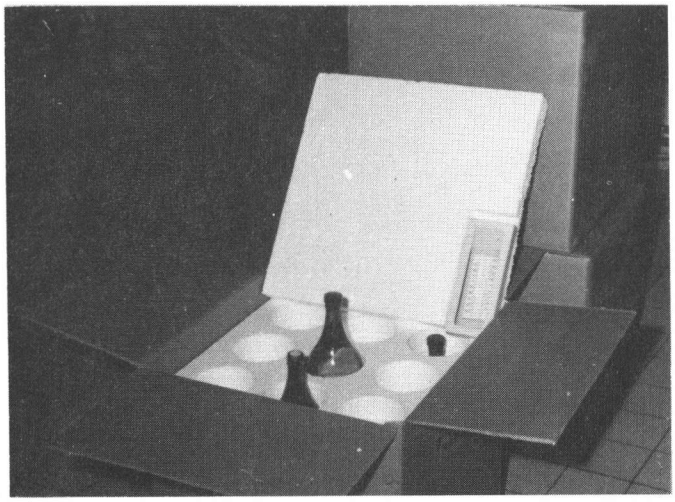
The duration of transport varied, in some cases the journey took as long as 18 days (Table 8.1.). This (and other reasons) caused a delay in the scheduled October 5th, 1974, return of the results, so that only one third of the results were received on that date by the rapporteur. This made it difficult to give the final evaluations to the participants at the scheduled meeting on the 4th and 5th November, 1974, in Luxembourg (see appendix 10.6.). The results and details of the analytical

Technical Preparations

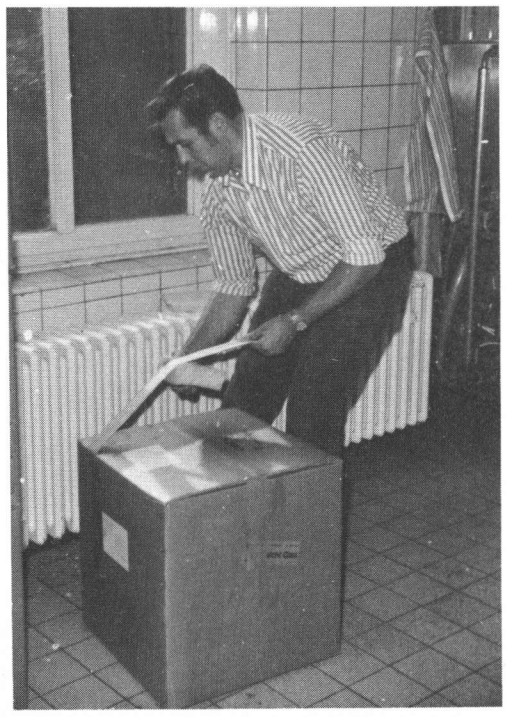
I



II



III



IV

I. Bottling of samples from the container

II. Samples before packing

III. Sample boxes, filled with polystyrene for thermoisolation. At the right side of the lid the minimal-maximal thermometer for temperature measurement

IV. Finished packages

methods that were not sent up to this time were compiled and the results found were discussed at this meeting.

3. Selected preliminary investigations

(carried out by the Ruhrverband und Ruhrtalsperrenverein, Essen)

3.1. Absorption behavior

Corks, bottles and precipitates of the samples were investigated for possible absorption of aliphatic hydrocarbons. The corks used to seal the bottles were shaken intensively for 20 hours in water (sample C) and the contents of the corks extracted with CCl_4. Infra-red measurements showed that the total absorption of a cork was as much as 1 % of the total hydrocarbons present in a bottle. Taking into consideration the geometric ratio of the corks surface in contact with the sample material the results would not therefore be affected. In a further experiment using sample water C the hydrocarbons in the precipitates (mainly calcium and magnesium salts) were extracted with CCl_4 and the empty bottle was washed three times with CCl_4. The combined extractions were analyzed for aliphatic hydrocarbons by the IR-method. No significant absorption by the precipitate or the glass was detected.

3.2. Time dependence

To control the possible decay of phenols in the course of time an aliquot of sample A was analyzed over a period of 20 days for the phenol content. The results are shown in Figure 9.6. A slight increase of the concentration could be detected by the 6th day after preparation, then a decrease of phenol concentration to the original value by the 20th day. The time dependence of the concentration of cyanides will be discussed in chapter 6.

4. General results

The results of the measurements of the individual participating laboratories are presented in tables 8.2. - 8.3. and figures 9.2. - 9.3. for cyanides and phenols. Some of the 10 participants determined the hydrocarbon content as total organic carbon (TOC), but the others determined only aliphatic hydrocarbons. These results are shown in tables 8.4. and figures 9.4. - 9.5. In the following the determination of TOC will be treated as an additional parameter along with aliphatic hydrocarbons.

As already mentioned results were received by the rapporteur after some delays. Even then, the required detailed description of the analytical methods used for the determination were, in many cases, inadequate making an exact interpretation of the data difficult. Therefore at the meeting in Luxembourg on the 4th and 5th of November, 1974, questionnaires were distributed to collect the informations necessary for evaluation (see appendix 10.4.). These informations on the analytical methods used by the participating laboratories in this comparative study are summarized in tables 8.5. - 8.8.

5. Statistical methods

Several statistical tests were made on the results from the individual laboratories. First, all the measurements of one sample were combined and tested for outliers, using the NALIMOV procedure *. Mean, standard deviation for single measurements, standard deviation for the mean and the 95 %-confidence

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* Kaiser, R., and G. Gottschalk: Elementare Tests zur Beurteilung von Meßdaten, Hochschultaschenbücher Bd. 774, B.I.-Wissenschaftsverlag Mannheim 1972

interval were calculated excluding outliers.

In tables 8.9. these data are given. Outliers are identified by *. Additionally for each laboratory (or in case several methods were used, for each series of measurement), mean and standard deviation are given. Due to the large variation in the results of measurements additional tests for the variation of mean $\bar{x}$ and standard deviations were made on the normally used range ($\bar{x} \pm 4s$) for identification of outliers. Only small changes resulted which were taken into consideration in the discussion of the measurement parameters in the following sections. The different values of mean and standard deviation are summarized in table 8.9. The individual measurements are not 'normally distributed' as shown by x^2-tests, even when outliers have been eliminated. The homogeneity of the data could not be proven by variance analysis. Regrouping of the individual measurements according to the analytical methods did not lead to better homogeneity. Test comparisons between samples A and B were made for all measurements as well as for each series of measurements from the individual laboratories.

6. Discussion

6.1. Determination of cyanides

Of the 28 laboratories which determined cyanides only three did not distil the sample. 24 laboratories applied colorimetric measurement using the colour-reaction pyridine-pyrazolone (17 laboratories), pyridine-p-phenylenediamine (4 laboratories) or pyridine-barbituric acid (2 laboratories). Ion-selective electrodes were used by 4 laboratories and 3 carried out titrimetric determinations (see table 8.5.).

For all the different methods the results were spread over a wide range (figure 9.2.). For sample C, where the concentration was higher, the values are grouped more closely except for a few outliers (figure 9.7.). The trial to combine groups according to analytical methods did not lead to better results, i.e. for all methods the range seems to be high, even though the results from one individual laboratory agreed very well. A collaborative study organized in Germany last year showed differences of the same magnitude*.

Samples A and B, originally bottled from the same container, showed no significant difference in the mean which was 0,1 mg/l (standard deviation 0,07 mg/l) (see table 8.9.). When comparing the 29 series of measurements at the 1 % significance level 10 means were different, 15 not, 4 could not be compared statistically because each series was identical. The means of sample B were slightly higher than those of A in most cases (see Youden plot at figure 9.3.).

The mean of all determinations of sample C made in the first 25 days after sampling agrees with the theoretical concentration of 4 mg CN^-/l (original concentration plus spiking). This value lies within the 95 % confidence interval of the mean: 3,81 $\pm$ 0,25 mg/l (group CII in last table 8.9.). However when the determinations were made at a later date the measured values were lower (figure 9.6. - 9.7.).

An evaluation of the time dependence shows therefore a significant division into 2 groups:

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* unpublished, quoted in "Der Spiegel", Nr. 44 (1974)

1. measurement after the 25 th day
2. measurement before the 25th day after sampling.

Both groups in the last table 8.9. are identified by AI and AII etc. The concentration of cyanides evidently decreased with increasing age of the samples. Therefore it seems appropriate for future collaborative tests to set a time limit of 20 days for sampling, mailing and measurement. Further explanations for the variation of the results could not be found. One laboratory reported a calculating mistake for which the true value is lower by one order of magnitude (Lab. C).

6.2. Determination of phenols

By all but two laboratories, which use gas chromatography or thin-layer chromatography the phenol content was determined by colorimetric methods. The colour-reagent 4-amino-antipyrine was used by 26 laboratories, other colour-reagents by 4 laboratories. The samples were prepared for analysis mostly by distillation, but also by filtration or extraction (table 8.6.). The final evaluation did not show any significant differences caused by the different methods.

2,6-dichlorophenol had been used for spiking sample C when preparing the samples. This compound could have been detected only by gas chromatography or thin-layer chromatography. These methods, however, were only applied qualitatively by two laboratories. Using the colorimetric method, 2,6-dichlorophenol can be determined by the reaction with p-nitraniline up to 5 % only or, with 4-amino-antipyrine, up to 9 %. Therefore no difference could be expected in the measurements of sample A and B on one hand and sample C on the other.

The results of the determination of phenols were clearly grouped more closely together than those of cyanides (figure 9.3. and 9.7.). However, it must be recalled that the measured concentrations lay in a range which correspondended to that of a heavily polluted surface water.

No explanation could be found for the outlying results of some laboratories. The investigation on time dependence which had been carried out as one of the preliminary examinations (see section 3.2.) had shown slight changes of the phenol content during the first 10 days (figure 9.6.1.). When evaluating the results of all measurements by the participating laboratories no time dependence of the measured concentrations could be detected (see figure 9.6.2.). The mean values of samples A, B and C show - as was to be expected - no significant difference. The mean concentrations of phenols are 7,8 mg/l (standard deviation 1,0 mg/l) (see tables 8.9.). When comparing the means of 33 individual series of measurements of samples A and B only 4 were different at the 1 % significance level (see Youden plot at figure 9.3.).

6.3. Determination of total organic carbon

Instead of, or in addition to, the determination of aliphatic hydrocarbons 6 of the participating laboratories analyzed the samples for total organic carbon. For this they measured either the carbon dioxide, formed from the organic carbon, by an IR-detector (3 laboratories) or methane by a flame-ionisation-detector (3 laboratories) (see table 8.7.). The specific methods of measurement could not account for the differences of the individual results (see table 8.3.). Only

the values of one laboratory showed significant differences according to whether the samples had been mixed or centrifigated and decanted before measurement. The difference between the mean values of samples A and B is significant on the 1 % level. At the same significance level 3, out of 7 series of measurements, were different and 4 not. Due to the limited number of results any time dependence could not be evaluated.

6.4. Determination of aliphatic hydrocarbons

Determinations of the content of aliphatic hydrocarbons were carried out by 16 laboratories using the infra-red method. One laboratory determined the residue by gravimetry after acidification and extraction with petroleum ether; their measurements having the largest variation of single values. When determining the hydrocarbons by the IR-method the standard deviations of the single values were in some cases quite small (see figure 9.5.). A comparison of all measurement results showed large differences which could not be accounted for by different precleaning with and without absorption on florisil or Al_2O_3. The significant difference of the means of samples A and B could not be explained. Even though sample B was bottled before sample A from the water container the concentrations found were lower in B than in A, the mean of B being 0,9 mgC/l compared to 1,9 mg C/l in A. The assumption that part of the hydrocarbons evaporated during the bottling procedure could explain why sample C showed the lowest concentrations, having been bottled 24 hours later. But in this case, the mean of sample A should also have been lower than that of B. Storage time effects, until the samples were

analysed, could not be detected because of the large variations in the results.

7. Summary

With the participation of 34 laboratories from 8 Member States of the European Community a preliminary collaborative study on the detection of cyanides, phenols and hydrocarbons in surface water was conducted. The samples were received by nearly all participants within 6 days of shipment, only the transport to 7 participants taking a longer time. With a few exceptions the variation in temperature during transport was relatively small.

Each participating laboratory chose the method of analyzing the samples. An appraisal of the particular methods could not be done.

In detail the evaluation showed that the determination of hydrocarbons and cyanides in surface water may lead to considerably different results. In higher concentration ranges (> 1 mg CN^-/l) the results of the measurements of cyanide content were in better agreement. In the concentration range given in this study the determinations of phenol showed the smallest variation of all parameters studied. In general the results of the multiple determinations of all parameters by the individual laboratories agreed fairly well.

Page

8. Tables

TIME AND TEMPERATURE DURING TRANSPORT

Laboratory code no.	Date of departure	Date of arrival	Maximal temperature	Minimal temperature
A	29-8-74	3-9-74	29° C	
B	29-8-74	5-9-74	37	
C	29-8-74	5-9-74	37	
D	29-8-74	2-9-74	35	
E	29-8-74	29-8-74	26	
F	29-8-74	no data available		
G	29-8-74	29-8-74	30	
H	29-8-74	3-9-74	31	
I	29-8-74	5-9-74	30	
J	29-8-74	5-9-74	32	
K	29-8-74	3-9-74	22	
L	29-8-74	16-9-74	26	18° C
M	29-8-74	4-9-74	24	
N	29-8-74	17-9-74	-	
O	29-8-74	11-9-74	22	
P	29-8-74	3-9-74	25	18° C
Q	29-8-74	3-9-74	34	
R	29-8-74	3-9-74	24	
S	29-8-74	2-9-74	29	
T	29-8-74	17-9-74	29	
U	29-8-74	3-9-74	29	
V	29-8-74	5-9-74	21	
W	29-8-74	samples have not been analyzed		
X	29-8-74	10-9-74	-	
Y	29-8-74	4-9-74	24	
Z	29-8-74	20-9-74	21	
a	29-8-74	no data available		
b	29-8-74	26-9-74	36	14° C
c	29-8-74	samples have not arrived		
d	29-8-74	4-9-74	30	
e	29-8-74	3-9-74	21	
f	29-8-74	3-9-74	29	
g	29-8-74	3-9-74	26	16° C
h	29-8-74	29-8-74	-	

C Y A N I D E S - individual results of measurement

Laborat. code no.	Sample A Date of analysis	Sample A concentration/mg/l/ x_1	x_2	x_3	x_4	Sample B Date of analysis	Sample B concentration/mg/l/ x_1	x_2	x_3	x_4	Sample C Date of analysis	Sample C concentration/mg/l/ x_1	x_2	x_3	x_4
A	5-9/9	0,001	0,016	0,007	0,005	9-10/9	0,005	0,010	0,004	0,008	10-11/9	2,152	2,490	2,490	1,920
C	9-17/9	1,100	1,260	1,253		19-27/9	0,337	0,553	0,506		1-15/10	26,000	28,000	20,500	
D	7/10	0,02	0,03	0,025	0,02	7/10	0,03	0,025	0,030	0,025	7/10	1,22	1,16	1,03	1,09
G	27/9	0,043	0,052	0,045	0,042	27/9	0,047	0,050	0,047	0,042	27/9	3,00	3,00	3,00	3,00
H	4-6/9	0,11	0,11	0,11	0,11	4-6/9	0,12	0,12	0,13	0,13	4-6/9	3,35	3,35	3,35	3,30
I	13/9	0,11	0,11	0,11	0,11	16/9	0,12	0,12	0,12	0,12	16/9	3,45	3,45	3,45	3,50
J	6/9	0,39	0,38	0,38	0,38	6/9	0,37	0,38	0,38	0,38	6/9	4,32	4,25	4,30	4,30
K	19/9	0,056	0,046	0,058	0,047	17/9	0,119	0,120	0,112	0,111	18/9	3,54	3,43	3,23	3,15
L	14/10	1,17	1,16			14/10	1,22	1,22			14/10	2,25	2,24		
M	10-11/9	0,142	0,136	0,139		10-11/9	0,153	0,157	0,164		10-11/9	3,42	3,40		
N	1/10	0,070	0,065			2-4/10	0,080	0,085	0,112		3/10	3,2	2,7		
P a)	5-11/9	0,630	0,630	0,600	0,640	5-11/9	0,560	0,570	0,530	0,530	5-11/9	3,120	3,200	3,200	3,160
b)		0,140	0,150	0,160	0,140		0,082	0,085	0,097	0,097		5,360	6,050	5,480	5,300
Q a)	4-11/9	5,3	3,15			4-11/9	4,6	2,35			4-11/9	11,6	5,8		
b)		4,55					3,25					8,7			
c)		2,92					1,82					5,9			
R	5/9	2,3	2,9	2,4	1,9	5/9	3,0	3,3	2,9	3,3	5/9	6,0	5,4	6,0	5,2
S	3-22/9	0,096	0,085			3-22/9	n.d.	n.d.	n.d.	n.d.	3-4/9	3,64	3,62		
T	19/9	0,14	0,16	0,17	0,18	19/9	0,18	0,16	0,16	0,18	19/9	3,0	3,7	3,5	3,4
U	1-2/10	0,030	0,031	0,031	0,030	1-2/10	0,038	0,035	0,038	0,033	1-2/10	3,19	3,06	3,50	3,44
V	18-27/9	0,15	0,16	0,19	0,14	18-27/9	0,23	0,20	0,23	0,23	18-27/9	2,4	3,2	3,0	2,7
X	12-13/9	0,17	0,17	0,15		12-13/9	0,19	0,20	0,18		12-13/9	3,87	3,86	3,78	
Y	30/9	0,13	0,13	0,12	0,13	30/9	0,14	0,14	0,14	0,14	1/10	4,2	4,0	3,9	4,1
Z	4/10	0,0496	0,0490	0,0497	0,050	4/10	0,023	0,0229	0,023	0,023	4/10	2,507	2,590	2,510	2,510
a	3/10	0,020	0,037	0,042	0,044	3/10	0,037	0,035	0,076	0,036	3/10	1,1	1,7	2,29	2,2
b	7-25/10	0,04	0,04	0,04		7-25/10	0,02	0,02	0,02		7-25/10	1,23	1,20	1,25	
d	5-6/9	0,150	0,165	0,160	0,150	5-6/9	0,195	0,170	0,145	0,165	5-10/9	4,875	5,00	5,125	5,125
e	4/9	0,13	0,13	0,13	0,12	4/9	0,14	0,14	0,13		4/9	2,7	2,7	2,9	
f	6-11/9	0,11	0,10	0,15	0,11	6-11/9	0,14	0,15	0,14	0,13	10-13/9	3,50	3,48	3,54	3,58
g	17/9	0,1	0,3	0,2	0,3	17/9	0,2	0,2	0,2	0,2	17/9	3,6	3,7	3,0	3,7
h	18/9	0,1 a)				18/9	0,1 a)				30/8	4,3 b)	4,3 b)		

CYANIDES - mean concentrations, lowest and highest concentrations of each laboratory

Laborat. code no.	Sample A: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]	Sample B: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]	Sample C: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]
A	5-9/9	4	0,007	0,001	0,016	9-10/9	4	0,007	0,004	0,010	10-11/9	4	2,263	1,920	2,490
C	9-17/9	3	1,171	1,100	1,260	19-27/9	3	0,464	0,333	0,553	1-15/10	3	24,833	20,500	28,000
D	7/10	4	0,024	0,020	0,030	7/10	4	0,027	0,025	0,030	7/10	4	1,14	1,08	1,22
G	27/9	4	0,045	0,042	0,052	27/9	4	0,046	0,042	0,050	27/9	4	3,00	3,00	3,00
H	4-6/9	4	0,11	0,11	0,11	4-6/9	4	0,12	0,12	0,13	4-6/9	4	3,34	3,30	3,35
I	13/9	4	0,11	0,11	0,11	16/9	4	0,12	0,12	0,12	16/9	4	3,46	3,45	3,50
J	6/9	4	0,38	0,38	0,39	6/9	4	0,38	0,37	0,38	6/9	4	4,29	4,25	4,32
K	19/9	4	0,052	0,046	0,058	17/9	4	0,115	0,111	0,120	18/9	4	3,34	3,15	3,54
L	14/10	2	1,16	1,16	1,17	14/10	2	1,22	1,22	1,22	14/10	2	2,25	2,24	2,25
M	10-11/9	3	0,139	0,136	0,142	10-11/9	3	0,158	0,153	0,164	10-11/9	2	3,41	3,40	3,42
N	1/10	2	0,067	0,065	0,070	2-4/10	3	0,092	0,080	0,112	3/10	2	3,0	2,7	3,2
P	5-11/9	4	0,625	0,600	0,640	5-11/9	4	0,547	0,530	0,570	5-11/9	4	3,170	3,120	3,200
		4	0,147	0,140	0,160		4	0,090	0,082	0,097		4	5,548	5,300	6,050
Q a)	4-11/9	2	4,22	3,15	5,3	4-11/9	2	3,5	2,35	4,6	4-11/9	2	8,7	5,8	11,6
b)		1	4,55				1	3,25				1	8,7		
c)		1	2,92				1	1,82				1	5,9		
R	5/9	4	2,4	2,3	2,9	5/9	4	3,1	2,9	3,3	5/9	4	5,6	5,2	6,0
S	3-22/9	2	0,090	0,085	0,096	3-22/9	4	n.d.	n.d.	n.d.	3-4/9	2	3,63	3,62	3,64
T	19/9	4	0,16	0,14	0,18	19/9	4	0,17	0,16	0,18	19/9	4	3,4	3,0	3,7
U	1-2/10	4	0,030	0,030	0,031	1-2/10	4	0,037	0,035	0,038	1-2/10	4	3,30	3,06	3,50
V	18-27/9	4	0,16	0,14	0,19	18-27/9	4	0,22	0,20	0,23	18-27/9	4	2,8	2,4	3,2
X	12-13/9	3	0,16	0,15	0,17	12-13/9	3	0,19	0,18	0,20	12-13/9	3	3,84	3,78	3,87
Y	30/9	4	0,13	0,12	0,13	30/9	4	0,14	0,14	0,14	1/10	4	4,0	3,9	4,2
Z	4/10	4	0,0496	0,0490	0,050	4/10	4	0,023	0,0229	0,023	4/10	4	2,529	2,507	2,590
a	3/10	4	0,036	0,020	0,044	3/10	4	0,046	0,035	0,076	3/10	4	1,82	1,1	2,29
b	7-25/10	3	0,04	0,04	0,04	7-25/10	3	0,02	0,02	0,02	7-25/10	3	1,23	1,20	1,25
d	5-6/9	4	0,156	0,150	0,165	5-10/9	4	0,169	0,145	0,195	5-10/9	4	5,031	4,875	5,125
e	4/9	4	0,13	0,12	0,13	4/9	3	0,14	0,13	0,14	4/9	3	2,8	2,7	2,9
f	6-11/9	4	0,12	0,10	0,15	6-11/9	4	0,14	0,13	0,15	10-13/9	4	3,52	3,48	3,58
g		4	0,2	0,1	0,3		4	0,2	0,2	0,2		4	3,5	3,0	3,7
h	18/9	1	0,1 a)			18/9	1	0,1 a)			30/8	2	4,3 b)	4,3 b)	4,3 b)

PHENOLS - individual results of measurement

Laborat. code no.	Sample A					Sample B					Sample C				
	Date of analysis	concentration [mg/l] x_1	x_2	x_3	x_4	Date of analysis	x_1	x_2	x_3	x_4	Date of analysis	x_1	x_2	x_3	x_4
A	6/9	7,15	5,7	7,6	6,4	6/9	7,6	8	8,7	7,9	6/9	8,15	5,7	7,3	7,3
B	11-13/9	11,5	12,0	11,8		11-13/9	12,4	12,0	12,4		11-13/9	11,8	12,0	11,5	
C	11-27/9	9,0	8,5	8,7		11-27/9	9,5	7,2	8,7		11-27/9	7,8	7,5	8,4	
E	6/9	7,55	7,53	7,52	7,48	6/9	7,72	7,72	7,77	7,82	9/9	8,07	8,07	8,09	7,97
F		7,1	6,4	6,9			6,5	6,6	6,1			6,8	6,6	6,3	
G	27/9	1,19	1,19	1,19	1,19	27/9	1,38	1,40	1,36	1,40	27/9	7,75	7,85	7,85	7,85
H	4-6/9	8,16	7,92	7,92		4-6/9	7,92	7,92	7,92	7,68	4-6/9	8,16	8,16	8,16	8,16
I	9/9	7,44	7,48	7,44		10/9	7,60	7,56	7,46		11/9	7,62	7,44	7,68	
J a)	10/9	9,4	9,4	9,0	9,4	10/9	9,0	9,0	9,2	9,8	10/9	9,4	9,0	9,4	9,6
J b)		9,4	9,5	9,4	9,5		10,0	9,6	9,6	9,6		9,5	9,6	9,5	9,5
K	5/9	7,6	6,9	7,6	7,6	5-6/9	7,0	7,35	7,6	7,0	6/9	7,0	7,1	7,2	7,0
L	7/10	7,6	7,7			7/10	7,6	7,8			7/10	7,8	8,0		
M	10-11/9	7,74	7,45	7,35		10-11/9	7,40	7,39	7,47		10-11/9	7,37	7,11	7,25	
N	24-25/9	8,00	8,24	8,24		25-26/9	7,94	8,00			26-27/9	8,28	8,00	7,88	
O	19/9	8,7	8,7			19/9	8,7	8,7			19/9	9,2	9,25		
P	4/9	2,86	2,88	2,90	2,80	4/9	2,96	2,98	2,83	2,97	4/9	2,80	2,70	2,70	3,00
Q	4-9/9	8,00	8,40	8,30	8,00	4-9/9	7,80	8,80	7,90	7,80	4-9/9	7,60	8,50	8,50	8,00
R	5/9	7,35	7,65	7,60	7,40	5/9	7,60	8,00	8,00	7,60	5/9	7,70	7,80	7,80	7,80
S	3-5/9	6,93	6,68			3-5/9	7,05	6,84			3-5/9	7,07	7,00		
T	23/9	8,8	9,2	9,1		23/9	8,4	8,8	9,0		23/9	8,8	8,7	8,8	
U	16-17/9	7,45	7,75	7,47	7,50	16-17/9	7,50	7,83	7,75	7,87	16-17/9	8,20	8,13	8,30	8,10
V a)	18-27/9	7,6	7,6	7,7	7,6	18-27/9	6,6	6,6	6,6	6,6	18-27/9	6,9	7,0	6,9	6,9
V b)		7,8	7,8				6,8	6,8				7,0	7,0		
X	12-13/9	16,0	13,7	12,7		12-13/9	14,8	12,2	16,4		12-13/9	15,8	14,1	15,7	
Y	30/9	7,6	7,7	7,8	7,6	1/10	7,7	7,7	7,6	7,7	1/10	7,8	7,7	7,7	7,7
Z	4/10	7,57	7,51	7,85	7,85	4/10	7,97	8,24	7,60	7,66	4/10	7,73	7,62	8,15	8,18
a	3/10	6,0	6,1	5,35	5,25	3/10	7,7	7,75	7,0	7,2	3/10	7,5	7,25	7,3	7,3
b	7-25/10	7,85	7,85	7,85		7-25/10	7,85	7,85	7,65		7-25/10	7,85	13,03	8,09	
d	6/9	8,00	8,00	8,00	8,00	6/9	7,95	8,10	8,00	8,15	6/9	7,95	7,85	8,00	8,00
e	4/9	9,5	9,6	9,3		4/9	6,8	6,9	6,6		4/9	9,1	9,1	9,2	
f	11-16/9	6,6	6,1	6,5	6,2	13-16/9	6,4	6,4	6,7	6,6	13-16/9	6,4	6,2	6,3	6,2
g		3,0					2,5					0,25			
h	30/8	7,1	7,1	6,6		30/8	7,5	7,4	7,3	6,3	30/8	7,5	7,5	6,8	7,3

3.3.

PHENOLS - mean concentrations, lowest and highest concentrations of each laboratory

Laborat. code no.	Date of arrival	Max. Temp. [°C]	Sample A: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]	Sample B: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]	Sample C: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]
A	3/9	28,5	6/9	4	6,71	5,7	7,6	6/9	4	8,05	7,6	8,7	6/9	4	7,1	5,7	8,15
B	5/9	37	11-13/9	3	11,8	11,5	12,0	11-13/9	3	12,3	12,0	12,4	11-13/9	3	11,8	11,5	12,0
C	5/9	37	11-27/9	3	8,7	8,5	9,0	11-27/9	3	8,5	7,2	9,5	11-27/9	3	7,9	7,5	8,4
E	29/8	26	6/9	4	7,52	7,48	7,55	6/9	4	7,76	7,72	7,82	9/9	4	8,05	7,97	8,09
F				3	6,8	6,4	7,1		3	6,4	6,1	6,6		3	6,6	6,3	6,8
G	29/8	30	27/9	4	1,19	1,19	1,19	27/9	4	1,39	1,36	1,40	27/9	4	7,83	7,75	7,85
H	2/9	30	4-6/9	3	8,00	7,92	8,16	4-6/9	4	7,86	7,68	7,92	4-6/9	4	8,16	8,16	8,16
I	5/9	26	9/9	3	7,45	7,44	7,48	9/9	3	7,54	7,46	7,60	9/9	3	7,58	7,44	7,68
J a	5/9	32	10/9	4	9,3	9,0	9,4	10/9	4	9,3	9,0	9,8	10/9	4	9,4	9,0	9,6
J b				4	9,4	9,4	9,5		4	9,7	9,6	10,0		4	9,5	9,4	9,6
K	3/9	28	5/9	4	7,4	6,9	7,6	5-6/9	4	7,24	7,0	7,6	6/9	4	7,08	7,0	7,2
L	16/9	26	7/10	2	7,6	7,6	7,7	7/10	2	7,7	7,6	7,8	7/10	2	7,9	7,8	8,0
M	4/9	24	10-11/9	3	7,51	7,35	7,74	10-11/9	3	7,42	7,39	7,47	10-11/9	3	7,24	7,11	7,37
N	17/9		24-25/9	3	8,16	8,00	8,24	25-26/9	2	7,97	7,94	8,00	26-27/9	3	8,05	7,88	8,28
O	11/9	22	19/9	2	8,7	8,7	8,7	19/9	2	8,7	8,7	8,7	19/9	2	9,2	9,2	9,25
P	3/9	25	4/9	4	2,86	2,80	2,90	4/9	4	2,94	2,83	2,98	4/9	4	2,80	2,70	3,00
Q	3/9	34	4-9/9	4	8,17	8,00	8,40	4-9/9	4	8,07	7,80	8,80	4-9/9	4	8,15	7,60	8,50
R	3/9	24	5/9	4	7,50	7,35	7,65	5/9	4	7,80	7,60	8,00	5/9	4	7,80	7,70	7,80
S	2/9	29	3-5/9	2	6,80	6,68	6,93	3-5/9	2	6,95	6,84	7,05	3-5/9	2	7,04	7,00	7,07
T	17/9	29	23/9	3	9,0	8,8	9,2	23/9	3	8,7	8,4	9,0	23/9	3	8,8	8,7	8,8
U	3/9	29	16-17/9	4	7,54	7,45	7,75	16-17/9	4	7,74	7,50	7,87	16-17/9	4	8,18	8,10	8,30
V a	5/9	21	18-27/9	4	7,6	7,6	7,7	18-27/9	4	6,6	6,6	6,6	18-27/9	4	6,9	6,9	7,0
V b				2	7,8	7,8	7,8		2	6,8	6,8	6,8		2	7,0	7,0	7,0
X	10/9		12-13/9	3	14,1	12,7	16,0	12-13/9	3	14,5	12,2	16,4	12-13/9	3	15,2	14,1	15,8
Y	4/9	24	30/9	4	7,7	7,6	7,8	1/10	4	7,7	7,6	7,7	1/10	4	7,7	7,7	7,8
Z	20/9	21	4/10	4	7,69	7,51	7,85	4/10	4	7,87	7,60	8,24	4/10	4	7,92	7,62	8,18
a			3/10	4	5,54	5,25	6,1	3/10	4	7,53	7,0	7,75	3/10	4	7,35	7,25	7,5
b	26/9	36	7-25/10	3	7,85	7,85	7,85	7-25/10	3	7,78	7,65	7,85	7-25/10	3	9,66	7,85	13,03
d	4/9	30	6/9	4	8,00	8,00	8,00	6/9	4	8,05	7,95	8,15	6/9	4	7,95	7,85	8,00
e	3/9	21	4/9	3	9,5	9,3	9,6	4/9	3	6,8	6,6	6,9	4/9	3	9,1	9,1	9,2
f	3/9	29	11-16/9	4	6,4	6,1	6,6	13-16/9	4	6,5	6,4	6,7	13-16/9	4	6,3	6,2	6,4
g	3/9	26		1	3,0				1	2,5				1	0,25		
h	30/8	20	30/8	3	6,9	6,6	7,1	30/8	3	7,1	6,3	7,5	30/8	3	7,4	6,8	7,5

TOTAL ORGANIC CARBON - individual results of measurement

Laborat. code no.	Sample A					Sample B					Sample C				
	Date of analysis	concentration [mg/l] x_1	x_2	x_3	x_4	Date of analysis	x_1	x_2	x_3	x_3	Date of analysis	concentration [mg/l] x_1	x_2	x_3	x_4
A a)	24/9	44	43,5	45	43,5	24/9	41,5	40	41	43	24/9	49	49,5	52	49,5
b)		53	53	54	52		45	46,5	48,5	47,5		55	56,5	54	55
U a)	1/10	47	43,5	43	40,5	1/10	41	41,5	40,5	41	1/10	53	51,5	49,5	51
b)		46,5	49,5	49,5	49		43	45,5	45	45		61	56,5	56	56
Y	30/9	52	52	52	52	30/9	46	46	46	45	30/9	55	55	55	55
e	4/9	49	47			4/9	47	44			4/9	51	49		
f	9/9	46,8	45,2	46,8		9/9	46,0	50,0	48,4	45,2	9/9	51,6	50,0	55,2	51,6
g		40,3					39,8					50,5			

ALIPHATIC HYDROCARBONS - individual results of measurement

Laborat. code no.	Sample A					Sample B					Sample C				
	Date of analysis	concentration [mg/l] x_1	x_2	x_3	x_4	Date of analysis	x_1	x_2	x_3	x_4	Date of analysis	concentration [mg/l] x_1	x_2	x_3	x_4
B	11-13/9	<0,4	<0,4	<0,4	<0,4	11-13/9	<0,4	<0,4	<0,4	<0,4	11-13/9	<0,4	<0,4	<0,4	<0,4
C	16-18/9	0,8	1,2	0,9		16-18/9	<0,4	<0,4	<0,4	<0,4	16-18/9	<0,4	<0,4	<0,4	<0,4
E	14/10	0,5	0,5	0,5	0,5	14/10	0,7	0,9	0,8	0,8	14/10	0,9	0,13	0,17	0,17
F		1,18					0,41					0,42			
G	27/9	3,8	2,1	4,4	4,4	27/9	1,1	1,8	1,6	2,1	27/9	3,5	3,2	2,8	2,9
H	10-17/9	2,45	2,28	2,38	2,52	10-12/9	0,70	0,68	0,49	0,52	10-12/9	0,24	0,52	0,35	0,32
K	13/9	4,1	3,9	3,9	4,2	12/9	1,8	1,8	1,6	1,3	11/9	1,2	1,2	1,3	1,4
L		3	2,4	2,2	1,8		1,5	1,1	1,1	0,8		1,6	0,9	1,2	0,7
M	24/9	14,2	11,3			24/9	12,2	10,9			24/9	11,4	4,73		
N a)	1/10	0,5	0,6			1/10	0,4	1,0			1/10				
b)		3,4	6,2	6,7	>10		2	2,4	2,8	3,5		3	3,6	3,7	4,0
O	20/9	1,75	1,7			20/9	0,4	0,4			20/9	0,4	0,4		
Q a)	13/9	0,5	0,5			13/9	0,25	0,25			13/9	0,17	0,17		
b)		2,9	2,9				1,3	1,3				1,2	1,2		
S	4/9	1,8	1,8	1,8	1,8	4/9	0,4	0,4	0,4	0,4	4/9	0,4	0,4	0,4	0,4
V	18-27/9	< 2				18-27/9	< 2				18-27/9	< 2			
f	18/9	7,4	3,5			18/9	7,0	2,0			18/9	2,4	2,0		
h	2/9	0,7	0,7	0,5		2/9	0,5	0,4			2/9	0,1	0,1	0,1	

TOTAL ORGANIC CARBON - mean concentrations, lowest and highest concentrations of each laboratory

Laborat. code no.	Date of arrival	Max. Temp. [°C]	Sample A: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]	Sample B: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]	Sample C: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]
A a)	3/9	28,5	24/9	4	44	43,5	45	24/9	4	41,5	40	43	24/9	4	50	49	52
A b)				4	53	52	54		4	47	45	48,5		4	55	54	56,5
U a)	3/9	29	1/10	4	44	40,5	47	1/10	4	41	40,5	41,5	1/10	4	51	49,5	53
U b)				4	48,5	46,5	49,5		4	44,5	43	45,5		4	57	56	61
Y	4/9	24	30/9	4	52	52	52	30/9	4	46	45	46	30/9	4	55	55	55
e	3/9	21	4/9	2	48	47	49	4/9	2	46	44	47	4/9	2	50	49	51
f	3/9	26	9/9	3	46,3	45,2	46,8	9/9	4	47,4	45,2	50,0	9/9	4	52,1	50,0	55,2
g				1	40,3				1	39,8				1	50,8		

ALIPHATIC HYDROCARBONS - mean concentrations, lowest and highest concentrations of each laboratory

Laborat. code no.	Date of arrival	Max. Temp. [°C]	Sample A: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]	Sample B: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]	Sample C: Date of analysis	n	$\bar{x}$ [mg/l]	x_{min} [mg/l]	x_{max} [mg/l]
B	5/9	37	11-13/9	4	<0,4		<0,4	11-13/9	4	<0,4		<0,4	11-13/9	4	<0,4		<0,4
C	5/9	37	16-18/9	3	1,0	0,8	1,2	16-18/9	3	<0,4		<0,4	16-18/9	4	<0,4		<0,4
E	29/8	26	14/10	4	0,5	0,5	0,5	14/10	4	0,8	0,7	0,9	14/10	4	0,34	0,13	0,9
F				1	1,18				1	0,41				1	0,42		
G	29/8	30	27/9	4	3,7	2,1	4,4	27/9	4	1,7	1,1	2,1	27/9	4	3,1	2,8	3,5
H	2/9	30	10-12/9	4	2,41	2,28	2,52	10-12/9	4	0,60	0,49	0,70	10-12/9	4	0,36	0,24	0,52
K	3/9	28	13/9	4	4,0	3,9	4,2	12/9	4	1,6	1,3	1,8	11/9	4	1,3	1,2	1,4
L	16/9	26		4	2,4	1,8	3		4	1,1	0,8	1,5		4	1,1	0,7	1,6
M			24/9	2	12,8	11,3	14,2	24/9	2	11,6	10,9	12,2	24/9	2	8,06	4,73	11,4
N a)	17/9		1/10	2	0,6	0,5	0,6	1/10	2	0,7	0,4	1,0	1/10				
N b)				4	4,4	3,4	>10		4	2,7	2	3,5		4	3,6	3	4,0
O	11/9	22	20/9	2	1,7	1,7	1,75	20/9	2	0,4	0,4	0,4	20/9	2	0,4	0,4	0,4
Q a)	3/9	34	13/9	2	0,5	0,5	0,5	13/9	2	0,25	0,25	0,25	13/9	2	0,17	0,17	0,17
Q b)				2	2,8	2,9	2,9		2	1,3	1,3	1,3		2	1,2	1,2	1,2
S	2/9	29	4/9	4	1,8	1,8	1,8	4/9	4	0,4	0,4	0,4	4/9	4	0,4	0,4	0,4
V	5/9	21	18-27/9	1	<2		<2	18-27/9	1	<2		<2	18-27/9	1	<2		<2
f	3/9	29	18/9	2	5,5	3,5	7,4	18/9	2	4,5	2,0	7,0	18/9	2	2,2	2,0	2,4
h			2/9	3	0,6	0,5	0,7	2/9	2	0,5	0,4	0,5	2/9	3	0,1	0,1	0,1

Determination of C Y A N I D E S

Analytical methods used by the participating laboratories

Laboratory code no.	Sample pretreatment	Analytical determination	Concentration range*) /mg/l/	Detection limit /mg/l/
A	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	<0,5	0,001
C	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	0,002-0,1	0,002
D	-	ionselective electrode (standard addition)	0,01-100	0,01
C	-	colorimetric (pyridine-barbituric acid at 580 nm)		0,005
H	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	1 - 10	0,01
I	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	1 - 10	0,01
J	neutralisation	colorimetric (pyridine-pyrazolone at 620 nm)	0,01 - 0,1	0,01
K	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	0 - 0,1	0,001
L	distillation	colorimetric (pyradine-pyrazolone)		
M	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	0,01 - 1	0,01
N	distillation	colorimetric (pyridine-pyrazolone)		
P	a) without distillation b) with distillation	colorimetric (pyridine-pyrazolone at 620 nm)	<0,05	0,01
Q	distillation	a) ionselective electrode b) titrimetric (p-dimethylaminobenzalrhodanide) c) colorimetric (pyridine-pyrazolone at 620 nm)		
R	distillation	ionselective electrode		0,05
S	distillation	colorimetric (pyridine-pyrazolone at 620 nm)		
T	-	ionselective electrode	0,05 - 250	0,05
U	distillation	colorimetric (pyridine-p-phenylenediamine at 515 nm)	0,02 - 1	0,01
V	distillation	colorimetric (pyridine-p-phenylenediamine at 515 nm)		0,02
X	distillation at pH 7	colorimetric (pyridine-p-phenylenediamine at 515 nm)	<1	0,01
Y	distillation	colorimetric (pyridine-p-phenylenediamine at 515 nm)		0,02
Z	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	0,01 - 1 surface water, drinking water	0,001
a	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	0,01 - 1 surface water, drinking water	0,001
b	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	0,01 - 1 surface water, drinking water	0,001
d	distillation	colorimetric (pyridine-barbituric acid at 580 nm)	0,02 - 0,5	0,02
e	distillation	colorimetric (pyridine-pyrazolone at 630 nm)	0 - 10	0,005
f	distillation	colorimetric (pyridine-pyrazolone at 620 nm)	4 - 20	2
g	distillation	titrimetric (p-dimethylaminobensalrhodanide)	>0,1	0,1
h	distillation	a) colorimetric b) titrimetric (by Tyndall-effect)		

*) the method is normally used in for analysis of water samples

Determination of P H E N O L S

Analytical methods used by the participating laboratories

Laboratory code no.	Sample pretreatment	Analytical determination	Concentration range*) [mg/l]	Detection limit [mg/l]
A	filtration	colorimetric (4-amino-antipyrine at 530 nm), $CHCl_3$-extraction	<1,5	0,005
B	extraction (ether at pH2)	colorimetric (diazotized sulfanilic acid at 445 nm)		1
C	extraction (ether at pH2)	colorimetric (p-nitraniline at 475 nm)		0,01
E	filtration, neutralisation	colorimetric (4-amino-antipyrine at 470 nm), $CHCl_3$-extraction	>0,2 river water, ground water	0,005
F	extraction (di-ise-propyl-ether at pH 3)	colorimetric (4-amino-antipyrine at 460 nm), $CHCl_3$-extraction	0,0005-0,01	0,0005
G	-	colorimetric (4-amino-antipyrine)	0,2 - 2	0,1
H	distillation	colorimetric (4-amino-antipyrine at 510 nm)	1 - 50	0,1
I	distillation	colorimetric (4-amino-antipyrine at 460 nm), $CHCl_3$-extraction	0 - 1	0,005
J	distillation	a) colorimetric (4-amino-antipyrine at 510 nm) b) colorimetric (p-nitraniline at 472 nm)	1	0,1
K	distillation	colorimetric (4-amino-antipyrine at 460 nm), $CHCl_3$-extraction	0 - 2	0,01
L	distillation	colorimetric (4-amino-antipyrine)		
M	distillation	colorimetric (4-amino-antipyrine), $CHCl_3$-extraction		
N	filtration, distillation	colorimetric (4-amino-antipyrine)		
O				
P	distillation	colorimetric (4-amino-antipyrine at 510 nm)	0,02 - 10	0,02
Q	distillation	colorimetric (4-amino-antipyrine at 460 nm), $CHCl_3$-extraction	0,01 - 1	0,02
R	homogenisation, distillation	colorimetric (4-amino-antipyrine at 510 nm)	>0,5	0,02
S	distillation	colorimetric (4-amino-antipyrine at 510 nm)		
T	-	colorimetric (4-amino-yntipyrine at 510 nm)	1 - 5	0,05
U	distillation	colorimetric (4-amino-antipyrine at 460 nm), $CHCl_3$-extraction	0,01 - 1	0,01
V	a) neutralisation b) distillation	a) GLC for phenol and cresol b) colorimetric (4-amino-antipyrine at 510 nm)		b) 0,1
X	distillation	colorimetric (4-amino-antipyrine at 460 nm), $CHCl_3$-extraction	<0,1	0,005
Y	distillation	colorimetric (4-amino-antipyrine at 510 nm)	0 - 50	0,1
Z	distillation	colorimetric (4-amino-antipyrine at 510 nm)	0 - 50	1
a	distillation	colorimetric (4-amino-antipyrine at 510 nm), $CHCl_3$-extraction	0,5 - 5 surface water, drinking water	0,0005
b	distillation	colorimetric (4-amino-antipyrine at 510 nm)	0,5 - 5 surface water	0,0005
d	distillation	colorimetric (4-amino-antipyrine at 510 nm)	0,2 - 10	0,2
e	-	colorimetric (4-amino-antipyrine at 465 nm), $CHCl_3$-extraction	0 - 0,2 surface water 0 - 10 effluent	0,01
f	distillation	colorimetric (4-amino-antipyrine at 460 nm), $CHCl_3$-extraction	0 - 1	1
g	extraction (ether)	TLC for phenol, cresol and xylenol	drinking water	
h	distillation	colorimetric (uranylacetate-reagent)		

*) the method is normally used in for analysis of water samples

Determination of TOTAL ORGANIC CARBON

Analytical methods used by the participating laboratories

Laboratory code no.	Sample pretreatment	Analytical determination	Principle of the determination	Concentration range*) [mg/l]	Detection limit [mg/l]
A	a) unmixed probe b) mixed probe	Beckman TOC-analyser with IR-detector; standard: K-biphthalate, subtraction of inorganic carbon	$C_{org} \rightarrow CO_2$	<100	5
U	a) centrifugated probe b) mixed probe acidification with HNO_3 (pH 3) and degasing of CO_2	Phasesep TOCSIN-analyser with flame-ionisation-detector	$C_{org} \rightarrow CO_2 \rightarrow CH_4$	0,1 - 1000	0,1 - 0,5
Y	acidification with HNO_3 (pH 3) and degasing of CO_2	Phasesep TOCSIN-analyser with flame-ionisation-detector	$C_{org} \rightarrow CO_2 \rightarrow CH_4$		
e	acidification with HNO_3 (pH 3,5-4) and degasing of CO_2	Beckman TOC-analyser with IR-detector; standard: K-biphthalate	$C_{org} \rightarrow CO_2$	0 - 25 surface water	1
f	filtrated probe acidification (pH 2 - 3) and degasing of CO_2	Beckman TOC-analyser with IR-detector	$C_{org} \rightarrow CO_2$	0 - 20	1
g	acidification with HNO_3 and degasing of CO_2	Phasesep TOCSIN-analyser with flame-ionisation-detector	$C_{org} \rightarrow CO_2 \rightarrow CH_4$		0,1

*) the method is normally used in for analysis of water samples

Determination of H Y D R O C A R B O N S

Analytical methods used by the participating laboratories

Laborat. code no.	Sample pretreatment	Precleaning	Analytical determination	Concentration range*) /mg/l/	Detection limit /mg/l/
B	homogenisation, acidification, extraction	Florisil (column)	IR at 2870/2925/2960 cm^{-1}; 1 cm quartz-cells standard: iso-octane/hexadecane/benzene	0,1 - 8 river-, groundwater	0,4
C	homogenisation, acidification, extraction	Florisil (column)	IR at 2870/2925/2960 cm^{-1}; 1 cm quartz-cells standard: iso-octane/hexadecane/benzene	0,1 - 8 river-, groundwater	0,4
E	extraction	Al_2O_3 (column)	IR at 2870/2925/2960 cm^{-1}; 5 cm quartz-cells standard: gasoil	0,1 - 8 river-, groundwater	0,05
F	extraction	Florisil (batch)	IR at 2870/2925/2960 cm^{-1}; 5 cm quartz-cells standard: API-mixture	0,05- 0,5 river-, groundwater	0,05
G	extraction	-	IR at 2870/2925/2960 cm^{-1}; 5 cm quartz-cells standard: gasoil		0,05
H	acidification (pH 5), extraction	Florisil (batch)	IR at 2870/2925 cm^{-1}; 4 cm quartz-cells standard: hexadecane	0,01 - 10	0,01
K	acidification (pH 5), extraction	-	IR at 2870 cm^{-1}; 4 cm quartz-cells standard: iso-octane	0 - 25	0,2
L	extraction; use of Na_2SO_4 anhydr.	Florisil (column)	IR; standard: benzene/cetane/trimethylpentane		
M	acidification (pH 1), extraction	-	IR; standard: API-mixture		
N	extraction a) with and b) without centrifugation	-	IR		
O	extraction	-	IR		
Q	acidification, extraction, use of Na_2SO_4 anhydr.	a) with and b) without Florisil (column)	IR at 2925 cm^{-1}; 4 cm quartz-cells standard: hexadecane	>0,1	0,1
S	acidification (pH 5), extraction, use of Na_2SO_4 anhydr.	Florisil (column)	IR at 2925 cm^{-1}		0,2
V	acidification, extraction	Florisil (column)	IR: 2800 to 3100 cm^{-1}; 0,1 mm KBr-cells		2
f	acidification, extraction (petrol ether), use of Na_2SO_4 anhydr.	-	Evaporation of the extract and gravimetric determination of the residue	1	1
h	extraction	-	IR		

*) the method is normally used in for analysis of water samples

INTERLABORATORY TEST SAMPLE A CYANID

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
H	11Ø	11Ø	11Ø	11Ø	11Ø.Ø	
K	56	46	58	47	51.8	6.13
R	23ØØ*	29ØØ*	24ØØ*	19ØØ*	2375.Ø	411.3Ø
T	14Ø	16Ø	17Ø	18Ø	162.5	17.Ø8
FF	11Ø	1ØØ	15Ø	11Ø	117.5	22.17
G	43	52	45	42	45.5	4.51
Y	13Ø	13Ø	12Ø	13Ø	127.5	5.ØØ
DD	15Ø	165	16Ø	15Ø	156.3	7.5Ø
S	96	85			9Ø.5	7.78
I	11Ø	11Ø	11Ø	11Ø	11Ø.Ø	
EE	13Ø	13Ø	13Ø	12Ø	127.5	5.ØØ
U	3Ø	31	31	3Ø	3Ø.5	Ø.58
Q	53ØØ*	455Ø*	315Ø*	292Ø*	398Ø.Ø	1137.22
J	39Ø*	38Ø*	38Ø*	38Ø*	382.5	5.ØØ
V	15Ø	16Ø	19Ø	14Ø	16Ø.Ø	21.6Ø
N	7Ø	65			67.5	3.54
A	1	16	7	5	7.3	6.34
L	117Ø*	116Ø*			1165.Ø	7.Ø7
C	11ØØ*	126Ø*	1153*		1171.Ø	81.5Ø
GG	1ØØ	3ØØ*	3ØØ*	2ØØ	225.Ø	95.74
D	2Ø	3Ø	25	2Ø	23.8	4.79
X	17Ø	17Ø	15Ø		163.3	11.55
P1	14Ø	15Ø	16Ø	14Ø	147.5	9.57
P2	63Ø*	63Ø*	6ØØ*		62Ø.Ø	17.32
M	142	136	139		139.Ø	3.ØØ
Z	5Ø	5Ø	5Ø	5Ø	5Ø.Ø	
AA	2Ø	37	42	44	35.8	1Ø.9Ø
BB	4Ø	4Ø	4Ø		4Ø.Ø	
HH	1ØØ					

MEAN OF 8Ø MEASUREMENTS = 95.Ø MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
53.7 MICROGRAM/LITER = 56.5 PERCENT

STANDARD DEVIATION (MEAN)
6.Ø MICROGRAM/LITER = 6.3 PERCENT

CONFIDENCE INTERVAL (95%)
12.1 MICROGRAM/LITER = 12.7 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS USED BY A LABORATORY.

8.9.

INTERLABORATORY TEST SAMPLE B CYANID

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
H	12Ø	12Ø	13Ø	13Ø	125.Ø	5.77
K	119	12Ø	112	111	115.5	4.65
R	3ØØØ*	33ØØ*	29ØØ*	33ØØ*	3125.Ø	2Ø6.16
T	18Ø	16Ø	16Ø	18Ø	17Ø.Ø	11.55
FF	14Ø	15Ø	14Ø	13Ø	14Ø.Ø	8.16
G	47	5Ø	47	42	46.5	3.32
Y	14Ø	14Ø	14Ø	14Ø	14Ø.Ø	
DD	195	17Ø	145	165	168.8	2Ø.56
S	NN	NN	NN	NN		
I	12Ø	12Ø	12Ø	12Ø	12Ø.Ø	
EE	14Ø	14Ø	13Ø		136.7	5.77
U	38	35	38	38	37.3	1.5Ø
Q	46ØØ*	325Ø*	235Ø*	182Ø*	3ØØ5.Ø	1216.18
J	37Ø*	38Ø*	38Ø*	38Ø*	377.5	5.ØØ
V	23Ø	2ØØ	23Ø	23Ø	222.5	15.ØØ
N	8Ø	85	112		92.3	17.21
A	5	1Ø	4	8	6.8	2.75
L	122Ø*	122Ø*			122Ø.Ø	
C	333*	553*	5Ø6*		464.Ø	115.86
GG	2ØØ	2ØØ	2ØØ	2ØØ	2ØØ.Ø	
D	3Ø	25	3Ø	25	27.5	2.89
X	19Ø	2ØØ	18Ø		19Ø.Ø	1Ø.ØØ
P1	82	85	97	97	9Ø.3	7.89
P2	56Ø*	57Ø*	53Ø*	53Ø*	547.5	2Ø.62
M	153	157	164		158.Ø	5.57
Z	23	23	23	23	23.Ø	
AA	37	35	76	36	46.Ø	2Ø.Ø2
BB	2Ø	2Ø	2Ø		2Ø.Ø	
HH	1ØØ					

MEAN OF 8Ø MEASUREMENTS = 1Ø7.6 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
65.Ø MICROGRAM/LITER = 6Ø.4 PERCENT

STANDARD DEVIATION (MEAN)
7.3 MICROGRAM/LITER = 6.8 PERCENT

CONFIDENCE INTERVAL (95%)
14.6 MICROGRAM/LITER = 13.6 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS. NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS USED BY A LABORATORY.

8.9.

INTERLABORATORY TEST SAMPLE C CYANID

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
H	335Ø	335Ø	335Ø	333Ø	3345.Ø	1Ø.ØØ
K	354Ø	343Ø	323Ø	315Ø	3337.5	179.14
R	6ØØØ	54ØØ	6ØØØ	52ØØ	565Ø.Ø	412.31
T	3ØØØ	37ØØ	35ØØ	34ØØ	34ØØ.Ø	294.39
FF	35ØØ	348Ø	354Ø	358Ø	3525.Ø	44.35
G	3ØØØ	3ØØØ	3ØØØ	3ØØØ	3ØØØ.Ø	
Y	42ØØ	4ØØØ	39ØØ	41ØØ	4Ø5Ø.Ø	129.1Ø
DD	4875	5ØØØ	5125	5125	5Ø31.3	119.68
S	364Ø	362Ø			363Ø.Ø	14.14
I	345Ø	345Ø	345Ø	35ØØ	3462.5	25.ØØ
EE	27ØØ	27ØØ	29ØØ		2766.7	115.47
U	319Ø	3Ø6Ø	35ØØ	344Ø	3297.5	2Ø7.59
Q	116ØØ*	87ØØ*	58ØØ	59ØØ	8ØØØ.Ø	275Ø.76
J	432Ø	425Ø	43ØØ	43ØØ	4292.5	29.86
V	24ØØ	32ØØ	3ØØØ	27ØØ	2825.Ø	35Ø.ØØ
N	32ØØ	27ØØ			295Ø.Ø	353.55
A	2152	249Ø	249Ø	192Ø	2263.Ø	278.7Ø
L	225Ø	224Ø			2245.Ø	7.Ø7
C	26ØØØ*	28ØØØ*	2Ø5ØØ*		24833.3	3883.73
GG	36ØØ	37ØØ	3ØØØ	37ØØ	35ØØ.Ø	336.65
D	122Ø	116Ø	1Ø8Ø	1Ø9Ø	1137.5	65.51
X	387Ø	386Ø	378Ø		3836.7	49.33
P1	536Ø	6Ø5Ø	548Ø	53ØØ	5547.5	343.26
P2	312Ø	32ØØ	32ØØ	316Ø	317Ø.Ø	38.3Ø
M	342Ø	34ØØ			341Ø.Ø	14.14
Z	25Ø7	259Ø	251Ø	251Ø	2529.3	4Ø.52
AA	11ØØ	17ØØ	229Ø	22ØØ	1822.5	547.14
BB	123Ø	12ØØ	125Ø		1226.7	25.17
HH	43ØØ	43ØØ			43ØØ.Ø	

MEAN OF 97 MEASUREMENTS = 3391.8 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
1170.1 MICROGRAM/LITER = 34.5 PERCENT

STANDARD DEVIATION (MEAN)
118.8 MICROGRAM/LITER = 3.5 PERCENT

CONFIDENCE INTERVAL (95%)
238.7 MICROGRAM/LITER = 7.Ø PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS USED BY A LABORATORY.

8.9.

INTERLABORATORY TEST SAMPLE A PHENOL

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
H	8160	7920	7920		8000.0	138.56
K	7600	6900	7600	7600	7425.0	350.00
R	7350	7650	7600	7400	7500.0	147.20
F	7100	6400	6900		6800.0	360.56
T	8800	9200	9100		9033.3	208.17
FF	6600	6100	6500	6200	6350.0	238.05
G	1190*	1190*	1190*	1190*	1190.0	
Y	7600	7700	7800	7600	7675.0	95.74
O	8700	8700			8700.0	
DD	8000	8000	8000	8000	8000.0	
S	6830	6680			6755.0	106.07
I	7440	7480	7440		7453.3	23.09
EE	9500	9600	9300		9466.7	152.75
U	7450	7750	7470	7500	7542.5	139.85
B	11500*	12000*	11800*		11766.7	251.66
Q	8000	8400	8300	8000	8175.0	206.16
J1	9400	9400	9000	9400	9300.0	200.00
J2	9400	9500	9400	9500	9450.0	57.74
V1	7600	7600	7700	7600	7625.0	50.00
V2	7800	7800			7800.0	
N	8000	8240	8240		8160.0	138.56
A	7150	5700	7600	6400	6712.5	837.03
L	7600	7700			7650.0	70.71
E	7550	7530	7520	7480	7520.0	29.44
C	9000	8500	8700		8733.3	251.66
GG	3000*					
P	2860*	2880*	2900*	2800*	2860.0	43.20
X	16000*	13700*	12700*		14133.3	1692.14
M	7740	7745	7350		7611.7	226.62
Z	7570	7510	7850	7850	7695.0	180.65
AA	6000	6100	5350*	5250*	5675.0	436.84
BB	7850	7850	7850		7850.0	
HH	7100	7100	6600		6933.3	288.68

MEAN OF 92 MEASUREMENTS = 7803.4 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
884.8 MICROGRAM/LITER = 11.3 PERCENT

STANDARD DEVIATION (MEAN)
92.3 MICROGRAM/LITER = 1.2 PERCENT

CONFIDENCE INTERVAL (95%)
185.3 MICROGRAM/LITER = 2.4 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS USED BY A LABORATORY.

8.9.

INTERLABORATORY TEST SAMPLE 8 PHENOL

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
H	792Ø	792Ø	792Ø	768Ø	786Ø.Ø	12Ø.ØØ
K	7ØØØ	735Ø	76ØØ	7ØØØ	7237.5	292.62
R	76ØØ	8ØØØ	8ØØØ	76ØØ	78ØØ.Ø	23Ø.94
F	65ØØ	66ØØ	61ØØ		64ØØ.Ø	264.58
T	84ØØ	88ØØ	9ØØØ		8733.3	3Ø5.51
FF	64ØØ	64ØØ	67ØØ	66ØØ	6525.Ø	15Ø.ØØ
G	138Ø*	14ØØ*	136Ø*	14ØØ*	1385.Ø	19.15
Y	77ØØ	77ØØ	76ØØ	77ØØ	7675.Ø	5Ø.ØØ
O	87ØØ	87ØØ			87ØØ.Ø	
DD	795Ø	81ØØ	8ØØØ	815Ø	8Ø5Ø.Ø	91.29
S	7Ø5Ø	684Ø			6945.Ø	148.49
I	76ØØ	756Ø	746Ø		754Ø.Ø	72.11
EE	68ØØ	69ØØ	66ØØ		6766.7	152.75
U	75ØØ	783Ø	775Ø	787Ø	7737.5	166.Ø1
B	124ØØ*	12ØØØ*	124ØØ*		12266.7	23Ø.94
Q	78ØØ	88ØØ	79ØØ	78ØØ	8Ø75.Ø	485.63
J1	9ØØØ	9ØØØ	92ØØ	98ØØ*	925Ø.Ø	378.59
J2	1ØØØØ*	96ØØ	96ØØ	96ØØ	97ØØ.Ø	2ØØ.ØØ
V1	66ØØ	66ØØ	66ØØ	66ØØ	66ØØ.Ø	
V2	68ØØ	68ØØ			68ØØ.Ø	
N	794Ø	8ØØØ			797Ø.Ø	42.43
A	76ØØ	8ØØØ	87ØØ	79ØØ	8Ø5Ø.Ø	465.47
L	76ØØ	78ØØ			77ØØ.Ø	141.42
E	772Ø	772Ø	777Ø	782Ø	7757.5	47.87
C	95ØØ	72ØØ	87ØØ		8466.7	1167.62
GG	25ØØ*					
P	296Ø*	298Ø*	283Ø*	297Ø*	2935.Ø	7Ø.47
X	148ØØ*	122ØØ*	164ØØ*		14466.7	2119.75
M	74ØØ	739Ø	747Ø		742Ø.Ø	43.59
Z	797Ø	824Ø	76ØØ	766Ø	7867.5	296.58
AA	77ØØ	775Ø	7ØØØ	72ØØ	7412.5	37Ø.53
BB	75ØØ	74ØØ	73ØØ	63ØØ	7125.Ø	556.Ø3
HH	71ØØ	71ØØ	66ØØ		6933.3	288.68

MEAN OF 93 MEASUREMENTS = 7657.Ø MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
79Ø.9 MICROGRAM/LITER = 1Ø.3 PERCENT

STANDARD DEVIATION (MEAN)
82.Ø MICROGRAM/LITER = 1.1 PERCENT

CONFIDENCE INTERVAL (95%)
164.8 MICROGRAM/LITER = 2.2 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS
USED BY A LABORATORY.

3.9.

INTERLABORATORY TEST SAMPLE C PHENOL

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
H	8160	8160	8160	8160	8160.0	
K	7000	7100	7200	7000	7075.0	95.74
R	7700	7800	7800	7800	7775.0	50.00
F	6800	6600	6300		6566.7	251.66
T	8800	8700	8800		8766.7	57.74
FF	6400	6200	6300	6200	6275.0	95.74
G	7750	7850	7850	7850	7825.0	50.00
Y	7800	7700	7700	7700	7725.0	50.00
O	9200	9250			9225.0	35.36
DD	7950	7850	8000	8000	7950.0	70.71
S	7070	7000			7035.0	49.50
I	7620	7440	7680		7580.0	124.90
EE	9100	9100	9200		9133.3	57.74
U	8200	8130	8300	8100	8182.5	88.84
B	11800*	12000*	11500*		11766.7	251.66
Q	7600	8500	8500	8000	8150.0	435.89
J1	9400	9000	9400	9600	9350.0	251.66
J2	9500	9600	9500	9400	9500.0	81.65
V1	6900	7000	6900	6900	6925.0	50.00
V2	7000	7000			7000.0	
N	8280	8000	7880		8053.3	205.26
A	8150	5700*	7300	7300	7112.5	1023.37
L	7800	8000			7900.0	141.42
E	8070	8070	8090	7970	8050.0	54.16
C	7800	7500	8400		7900.0	458.26
GG	250*					
P	2800*	2700*	2700*	3000*	2800.0	141.42
X	15800*	14100*	15700*		15200.0	953.94
M	7370	7110	7250		7243.3	130.13
Z	7730	7620	8150	8180	7920.0	286.71
AA	7500	7250	7300	7300	7337.5	110.87
BB	7850	13030*	8090		9656.7	2923.86
HH	7500	7500	6800	7300	7275.0	330.40

MEAN OF 98 MEASUREMENTS = 7843.3 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
805.4 MICROGRAM/LITER = 10.3 PERCENT

STANDARD DEVIATION (MEAN)
81.4 MICROGRAM/LITER = 1.0 PERCENT

CONFIDENCE INTERVAL (95%)
163.5 MICROGRAM/LITER = 2.1 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS
USED BY A LABORATORY.

8.9.

INTERLABORATORY TEST SAMPLE A TOC

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
A1	44000	43500	45000	43500	44000.0	707.11
A2	53000	53000	54000	52000	53000.0	816.50
U1	47000	43500	43000	40500	43500.0	2677.06
U2	46500	49500	49500	49000	48625.0	1436.14
Y	52000	52000	52000	52000	52000.0	
EE	49000	47000			48000.0	1414.21
FF	46800	45200	46800		46266.7	923.76
GG	40300					

MEAN OF 26 MEASUREMENTS =47676.9 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
4054.9 MICROGRAM/LITER = 8.5 PERCENT

STANDARD DEVIATION (MEAN)
795.2 MICROGRAM/LITER = 1.7 PERCENT

CONFIDENCE INTERVAL (95%)
1638.2 MICROGRAM/LITER = 3.4 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS USED BY A LABORATORY.

D.D.

INTERLABORATORY TEST SAMPLE B TOC

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
A1	41500	40000	41000	43000	41375.0	1250.00
A2	45000	46500	48500	47500	46875.0	1493.04
U1	41000	41500	40500	41000	41000.0	408.25
U2	43000	45500	45000	45000	44625.0	1108.68
Y	46000	46000	46000	45000	45750.0	500.00
EE	47000	44000			45500.0	2121.32
FF	46000	50000	48400	45200	47400.0	2203.03
GG	39800					

MEAN OF 27 MEASUREMENTS =44403.7 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
2840.6 MICROGRAM/LITER = 6.4 PERCENT

STANDARD DEVIATION (MEAN)
546.7 MICROGRAM/LITER = 1.2 PERCENT

CONFIDENCE INTERVAL (95%)
1123.9 MICROGRAM/LITER = 2.5 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS. NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS USED BY A LABORATORY.

INTERLABORATORY TEST SAMPLE C TOC

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
A1	49000	49500	52000	49500	50000.0	1354.01
A2	55000	56500	54000	55000	55125.0	1030.78
U1	53000	51500	49500	51000	51250.0	1443.38
U2	61000*	56500	56000	56000	57375.0	2428.13
Y	55000	55000	55000	55000	55000.0	
EE	51000	49000			50000.0	1414.21
FF	51600	50000	55200	51600	52100.0	2200.00
GG	50500					

MEAN OF 26 MEASUREMENTS =52803.8 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
2611.6 MICROGRAM/LITER = 4.9 PERCENT

STANDARD DEVIATION (MEAN)
512.2 MICROGRAM/LITER = 1.0 PERCENT

CONFIDENCE INTERVAL (95%)
1055.1 MICROGRAM/LITER = 2.0 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS USED BY A LABORATORY.

INTERLABORATORY TEST SAMPLE A HYDCAR

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
B	4ØØ	4ØØ	4ØØ	4ØØ	4ØØ.Ø	
C	8ØØ	12ØØ	9ØØ		966.7	2Ø8.17
E	5ØØ	5ØØ	5ØØ	5ØØ	5ØØ.Ø	
F	118Ø					
G	38ØØ	21ØØ	44ØØ	44ØØ	3675.Ø	1Ø87.43
H	245Ø	228Ø	238Ø	252Ø	24Ø7.5	1Ø2.43
K	41ØØ	39ØØ	39ØØ	42ØØ	4Ø25.Ø	15Ø.ØØ
L	3ØØØ	24ØØ	22ØØ	18ØØ	235Ø.Ø	5ØØ.ØØ
M	142ØØ*	113ØØ*			1275Ø.Ø	2Ø5Ø.61
N	5ØØ	6ØØ			55Ø.Ø	7Ø.71
O	175Ø	17ØØ			1725.Ø	35.36
Q1	5ØØ	5ØØ			5ØØ.Ø	
Q2	29ØØ	29ØØ			29ØØ.Ø	
S	18ØØ	18ØØ	18ØØ	18ØØ	18ØØ.Ø	
V	2ØØØ					
FF	74ØØ*	35ØØ			545Ø.Ø	2757.72
HH	7ØØ	7ØØ	5ØØ		633.3	115.47

MEAN OF 45 MEASUREMENTS = 1854.7 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
1296.4 MICROGRAM/LITER = 69.9 PERCENT

STANDARD DEVIATION (MEAN)
193.3 MICROGRAM/LITER = 1Ø.4 PERCENT

CONFIDENCE INTERVAL (95%)
389.4 MICROGRAM/LITER = 21.Ø PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS USED BY A LABORATORY.

8.9.

INTERLABORATORY TEST SAMPLE B HYDCAR

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
B	400	400	400	400	400.0	
C	400	400	400	400	400.0	
E	700	900	800	800	800.0	81.65
F	410					
G	1100	1800	1600	2100	1650.0	420.32
H	700	680	490	520	597.5	107.82
K	1800	1800	1600	1300	1625.0	236.29
L	1500	1100	1100	800	1125.0	287.23
M	12200*	10900*			11550.0	919.24
N	400	1000			700.0	424.26
O	400	400			400.0	
Q1	250	250			250.0	
Q2	1300	1300			1300.0	
S	400	400	400	400	400.0	
V	2000					
FF	7000*	2000			4500.0	3535.53
HH	500	400			450.0	70.71

MEAN OF 45 MEASUREMENTS = 857.8 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
561.6 MICROGRAM/LITER = 65.5 PERCENT

STANDARD DEVIATION (MEAN)
83.7 MICROGRAM/LITER = 9.8 PERCENT

CONFIDENCE INTERVAL (95%)
168.7 MICROGRAM/LITER = 19.7 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS
USED BY A LABORATORY.

INTERLABORATORY TEST SAMPLE C HYDCAR

LAB	MEASURED CONCENTRATION (MICROGRAM/LITER)				MEAN	ST.DEV.
B	400	400	400	400	400.0	
C	400	400	400	400	400.0	
E	900	130	170	170	342.5	372.14
F	420					
G	3500*	3200*	2800*	2900*	3100.0	316.23
H	240	520	350	320	357.5	117.86
K	1200	1200	1300	1400	1275.0	95.74
L	1600	900	1200	700	1100.0	391.58
M	11400*	4730*			8065.0	4716.40
N						
O	400	400			400.0	
Q1	170	170			170.0	
Q2	1200	1200			1200.0	
S	400	400	400	400	400.0	
V	2000*					
FF	2400*	2000*			2200.0	282.84
HH	100	100	100		100.0	

MEAN OF 38 MEASUREMENTS = 562.1 MICROGRAM/LITER

STANDARD DEVIATION (SINGLE MEASUREMENT)
423.8 MICROGRAM/LITER = 75.4 PERCENT

STANDARD DEVIATION (MEAN)
68.7 MICROGRAM/LITER = 12.2 PERCENT

CONFIDENCE INTERVAL (95%)
139.3 MICROGRAM/LITER = 24.8 PERCENT

NOTE:
DOUBLE LETTERS ARE CODES OF LABORATORIES OTHERWISE CODED BY SMALL LETTERS.
NUMBERS COMBINED WITH LETTERS CHARACTERISE DIFFERENT ANALYTICAL METHODS USED BY A LABORATORY.

Mean and standard deviation of total of individual measurements

Parameter	Sample/ group	Number of accounted measurements	Number of outliers (NALIMOV test)	Mean $\bar{x}$ (mg/l)	Standard deviation (mg/l)	Number of accounted measurements	Number of outliers ($\bar{x} \pm 4s$)	Mean $\bar{x}$ (mg/l)	Standard deviation (mg/l)
Cyanides	A	80	22	0,095	0,054	82	20	0,100	0,062
	B	80	25	0,108	0,065	85+	20	0,106	0,071
	C	97	5	3,39	1,17	unchanged			
	A+B	160	47	0,101	0,060	167	40	0,103	0,066
	AI	29	2	0,052	0,033	unchanged			
	AII	51	20	0,119	0,048	53	18	0,126	0,058
	BI	30	2	0,054	0,041	unchanged			
	BII	50	23	0,140	0,055	55	18	0,134	0,068
	(A+B)I	59	4	0,053	0,037	unchanged			
	(A+B)II	101	43	0,129	0,052	108	36	0,130	0,063
	CI	9	-	2,50	0,98	unchanged			
	CII	66	5	3,81	1,01	unchanged			
Phenols	A	92	17	7,80	0,88	97	12	7,87	1,17
	B	93	17	7,66	0,79	95	15	7,70	0,85
	C	98	13	7,84	0,80	99	12	7,82	0,83
	A+B	185	34	7,73	0,84	192	17	7,79	1,02
Hydro-carbons	A	45	3	1,86	1,30	unchanged			
	B	45	3	0,86	0,56	unchanged			
	C	38	9	0,56	0,42	45	2	0,89	0,90
TOC	A	26	-	47,7	4,1	unchanged			
	B	27	-	44,4	2,8	unchanged			
	C	26	1	52,8	2,6	27	-	53,1	3,0

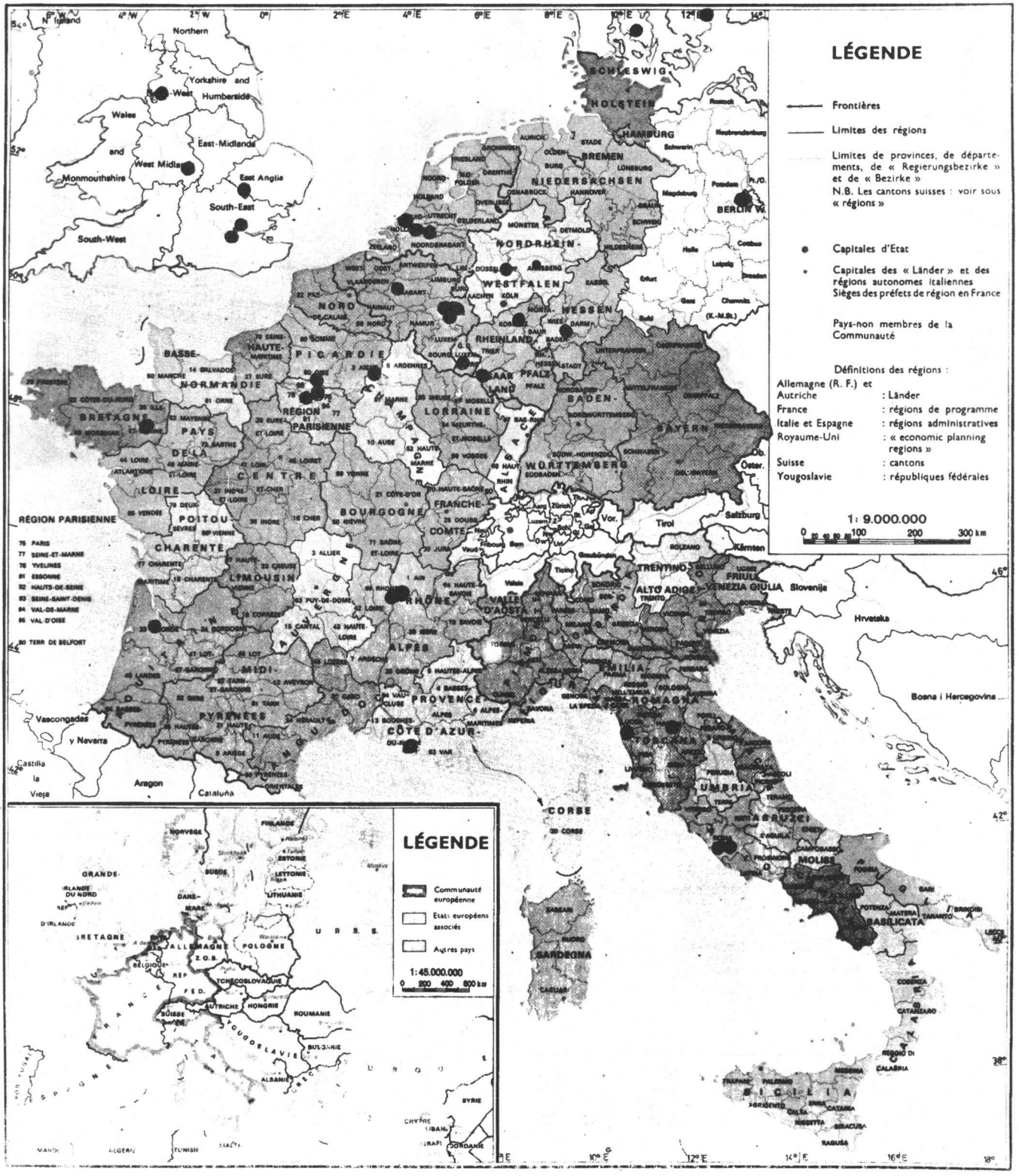
+0,01 mg/l taken for non detectable values (NN)

Page

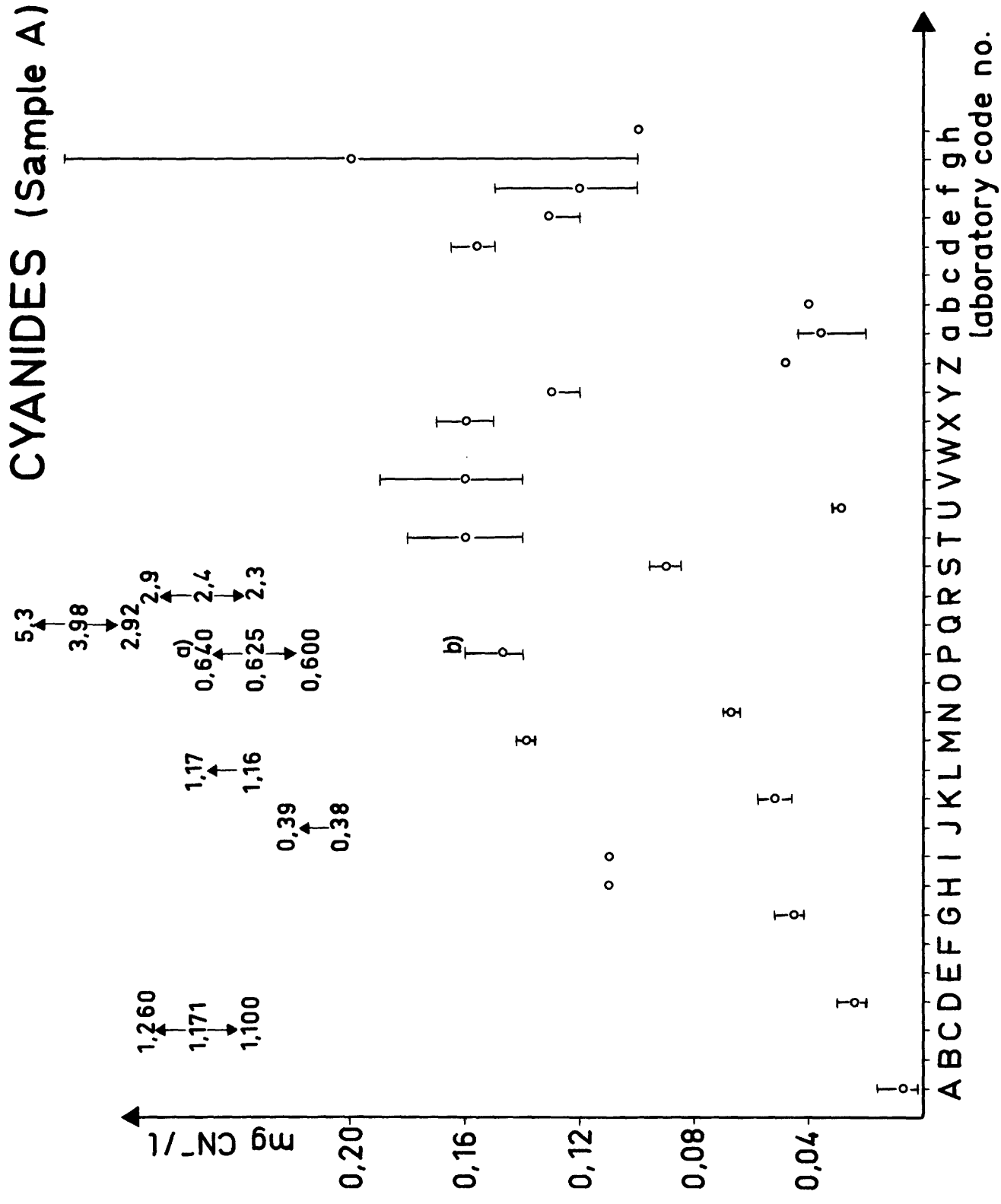
9. Figures

La Communauté européenne

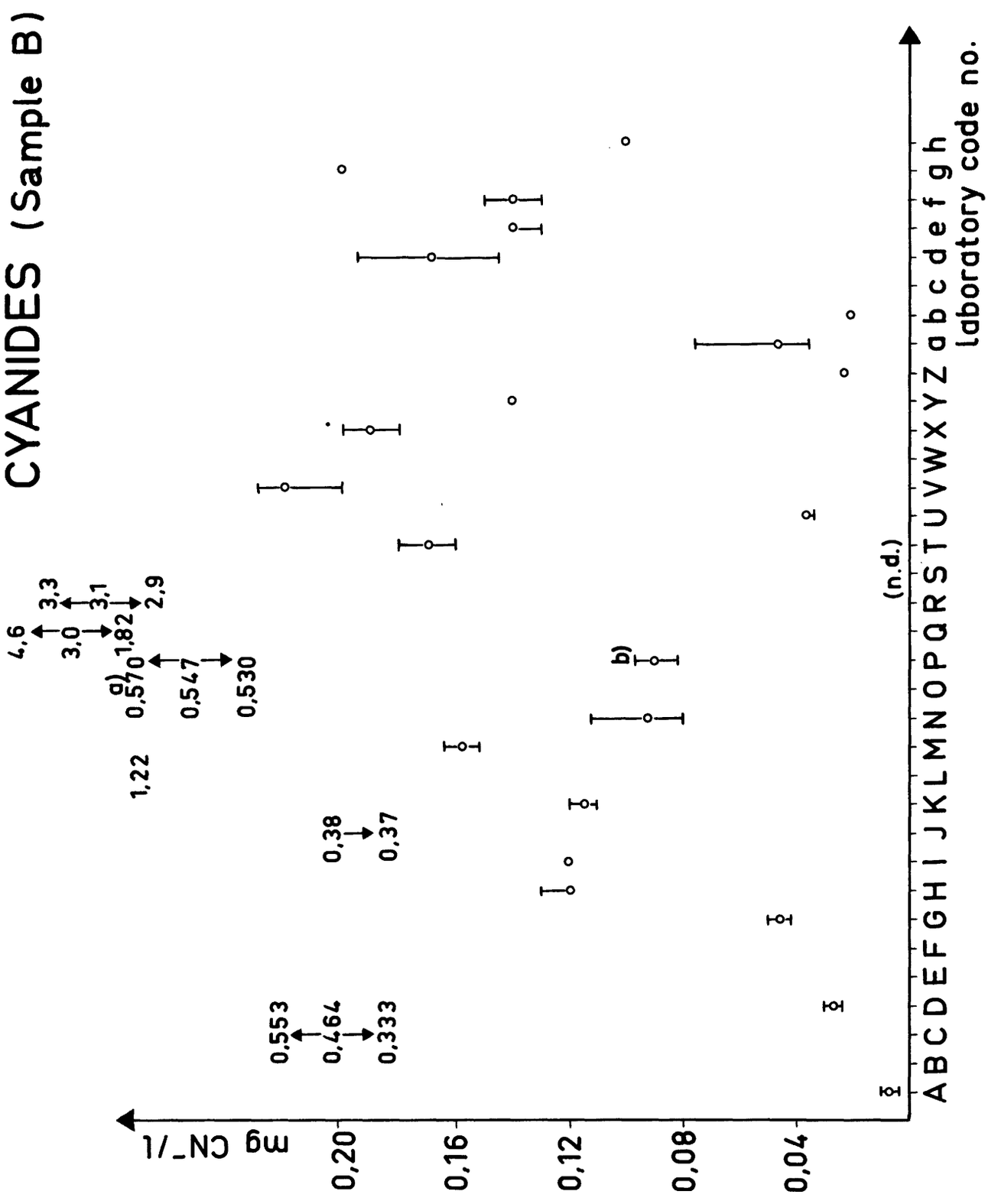
RÈGIONS ET UNITÉS ADMINISTRATIVES



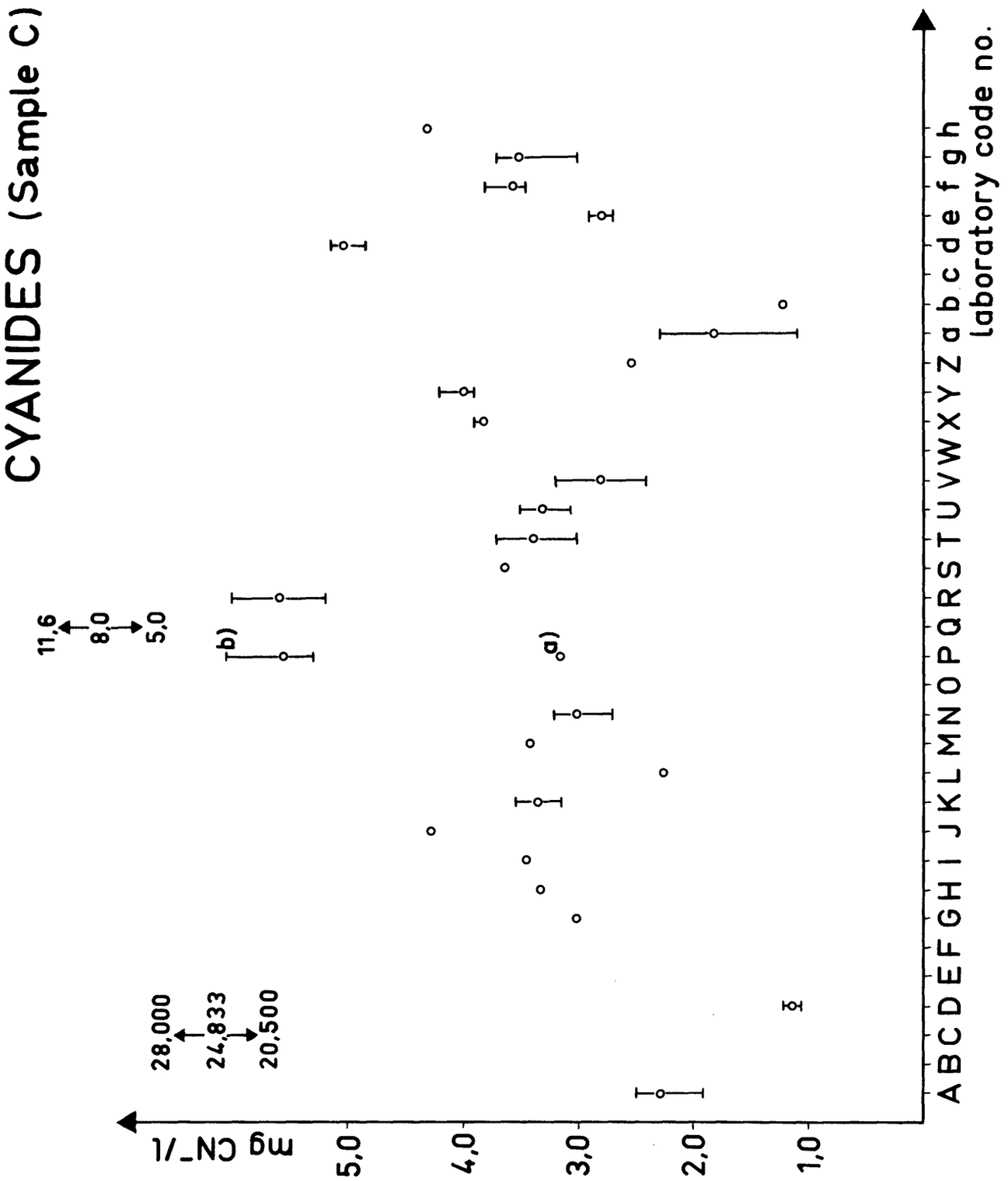
9.2.


CYANIDES (Sample A)
mg CN⁻/l
0,20
0,16
0,12
0,08
0,04
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h
laboratory code no.
5,3
3,98
2,92
2,9
2,4
2,3
a)
0,640
0,625
0,600
b)
1,17
1,16
0,39
0,38
1,260
1,171
1,100

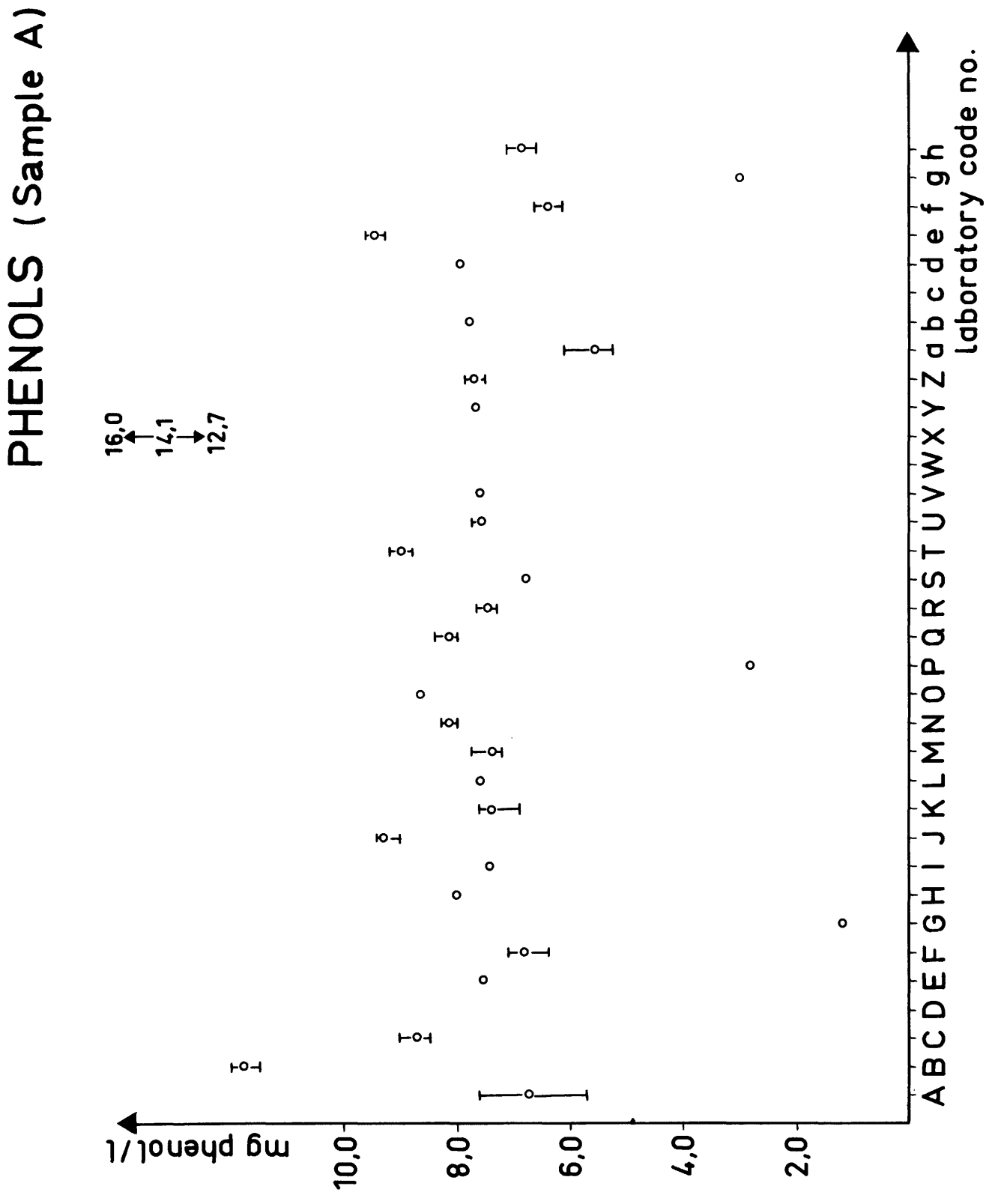
9.2.


CYANIDES (Sample B)
mg CN⁻/l
0,20
0,16
0,12
0,08
0,04
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h
laboratory code no.
(n.d.)
4,6
3,0
3,3
3,1
1,82
2,9
g)
0,570
0,547
0,530
1,22
0,38
0,37
b)
0,553
0,464
0,333

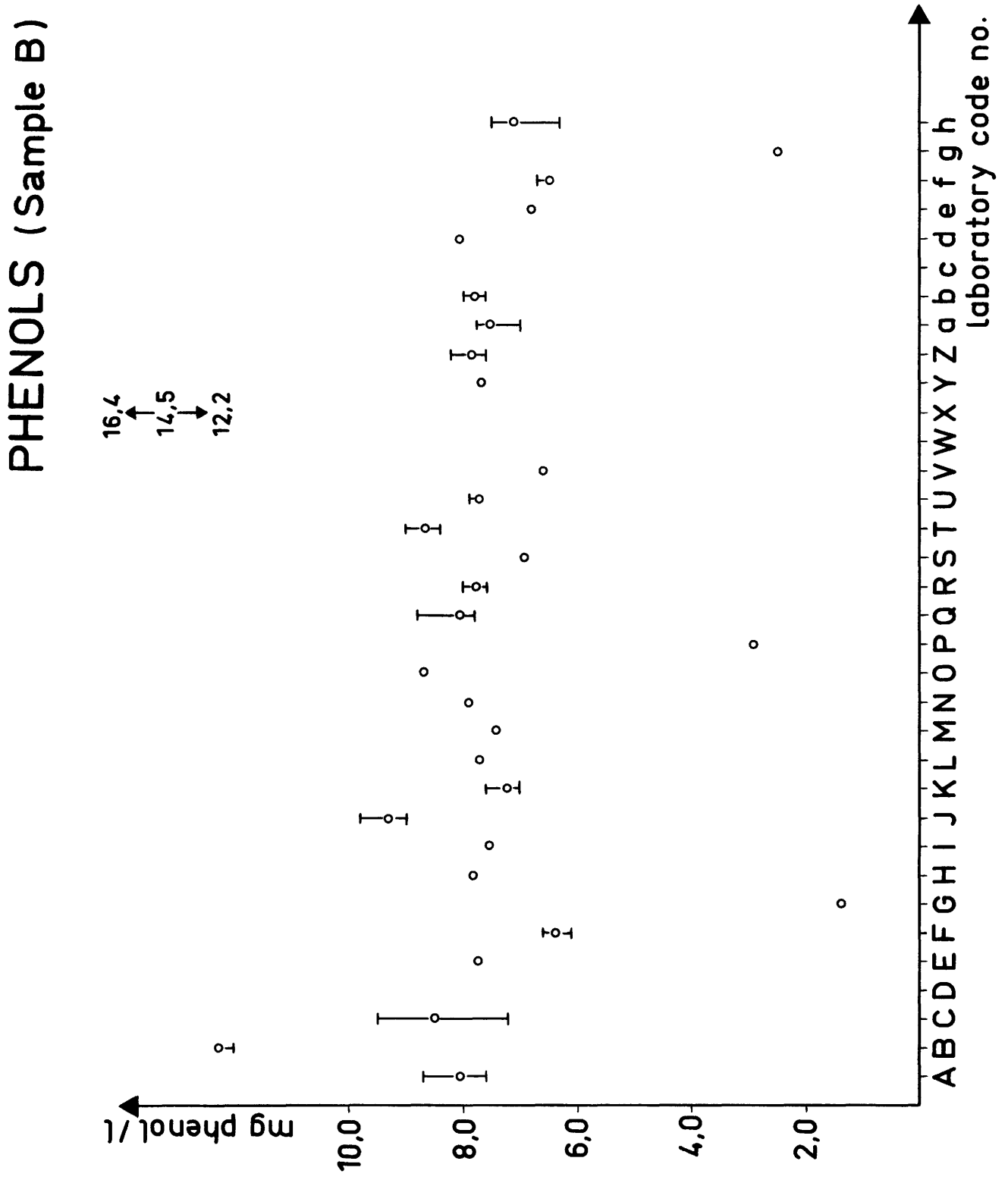
9.2.


CYANIDES (Sample C)
mg CN⁻/l
5,0
4,0
3,0
2,0
1,0
28,000
24,833
20,500
11,6
8,0
5,0
a)
b)
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h
laboratory code no.

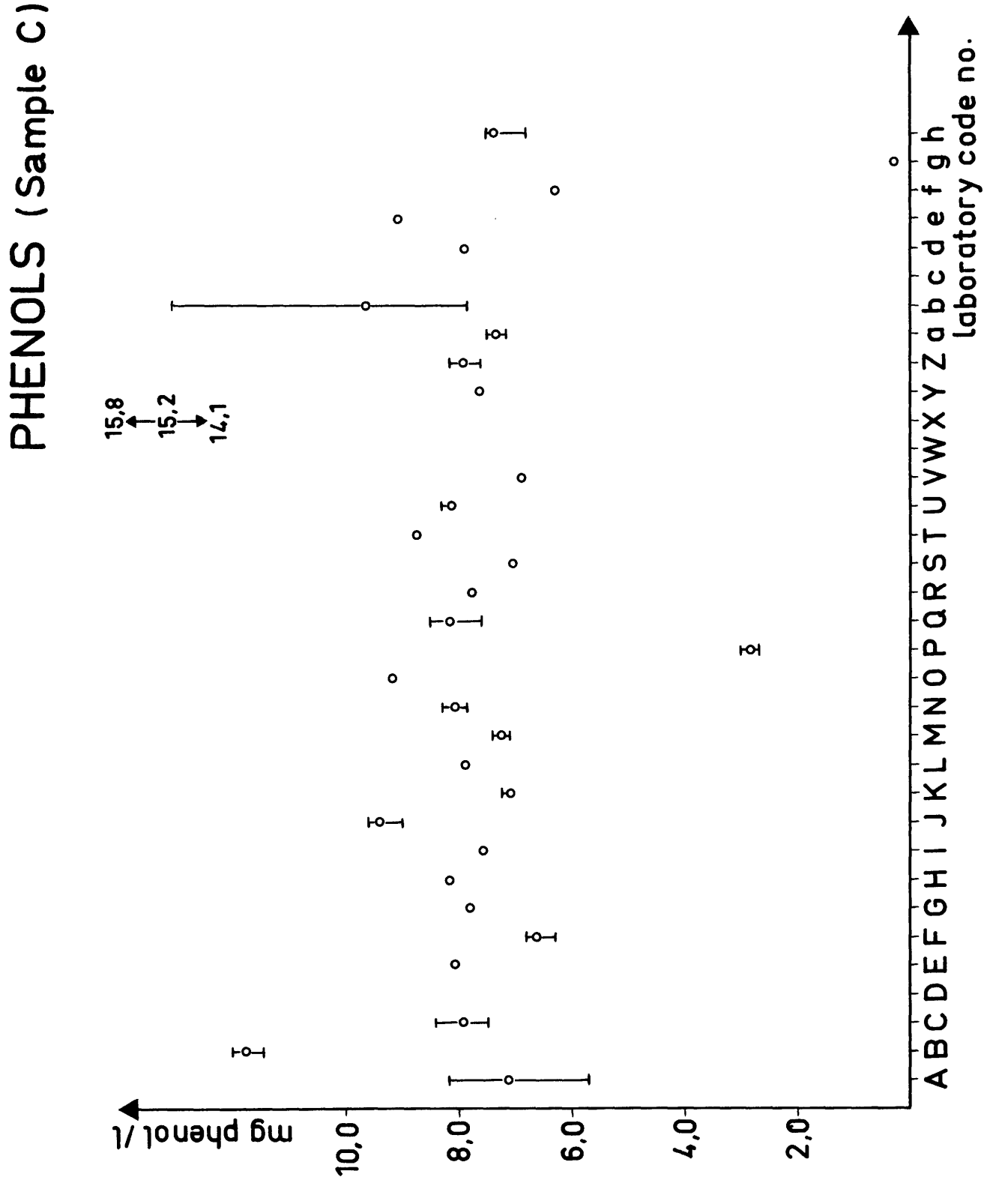
9.3.


PHENOLS (Sample A)
16,0
14,1
12,7
mg phenol/l
10,0
8,0
6,0
4,0
2,0
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h
laboratory code no.

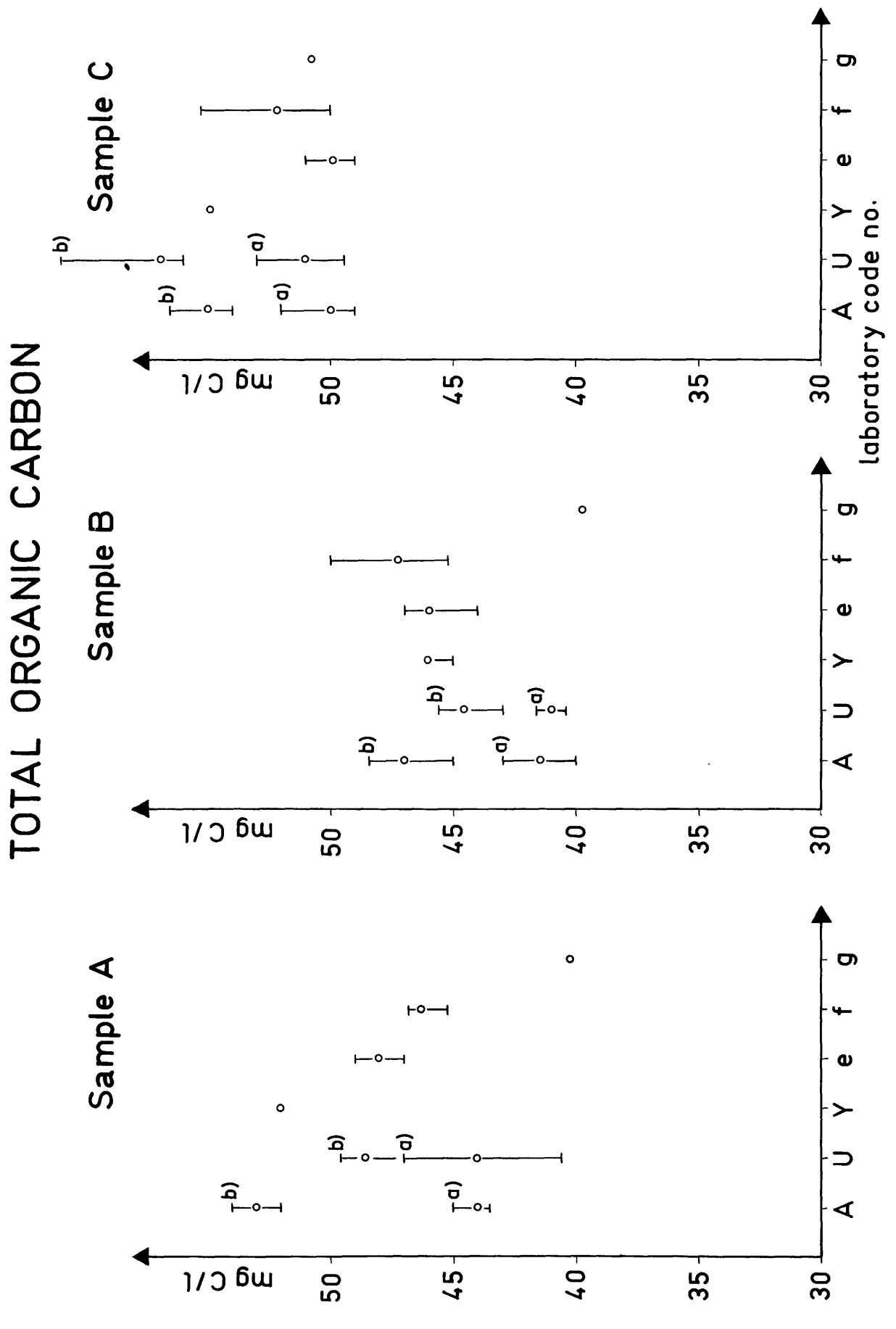
9.3.

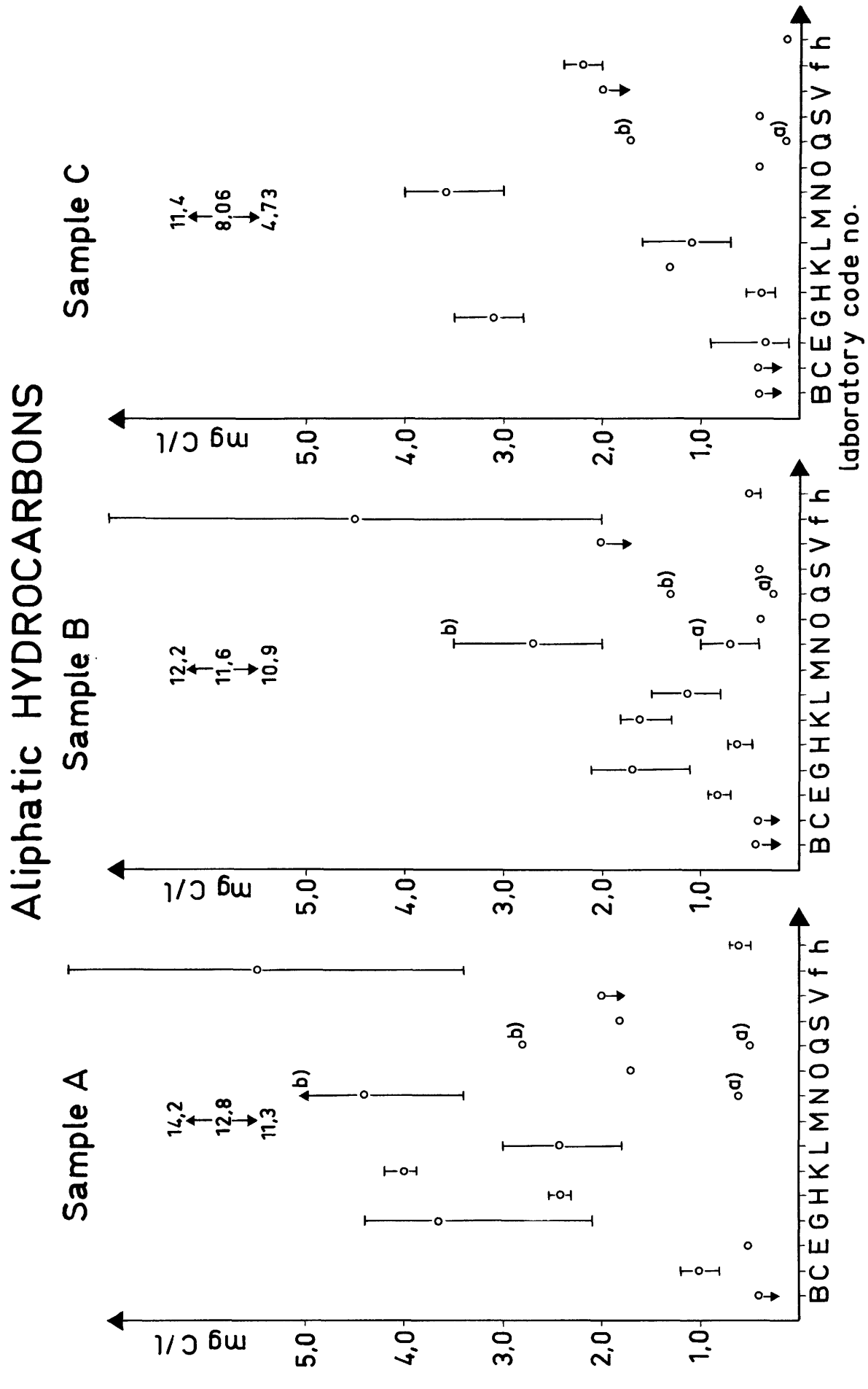

PHENOLS (Sample B)
16,4
14,5
12,2
mg phenol/l
10,0
8,0
6,0
4,0
2,0
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h
laboratory code no.

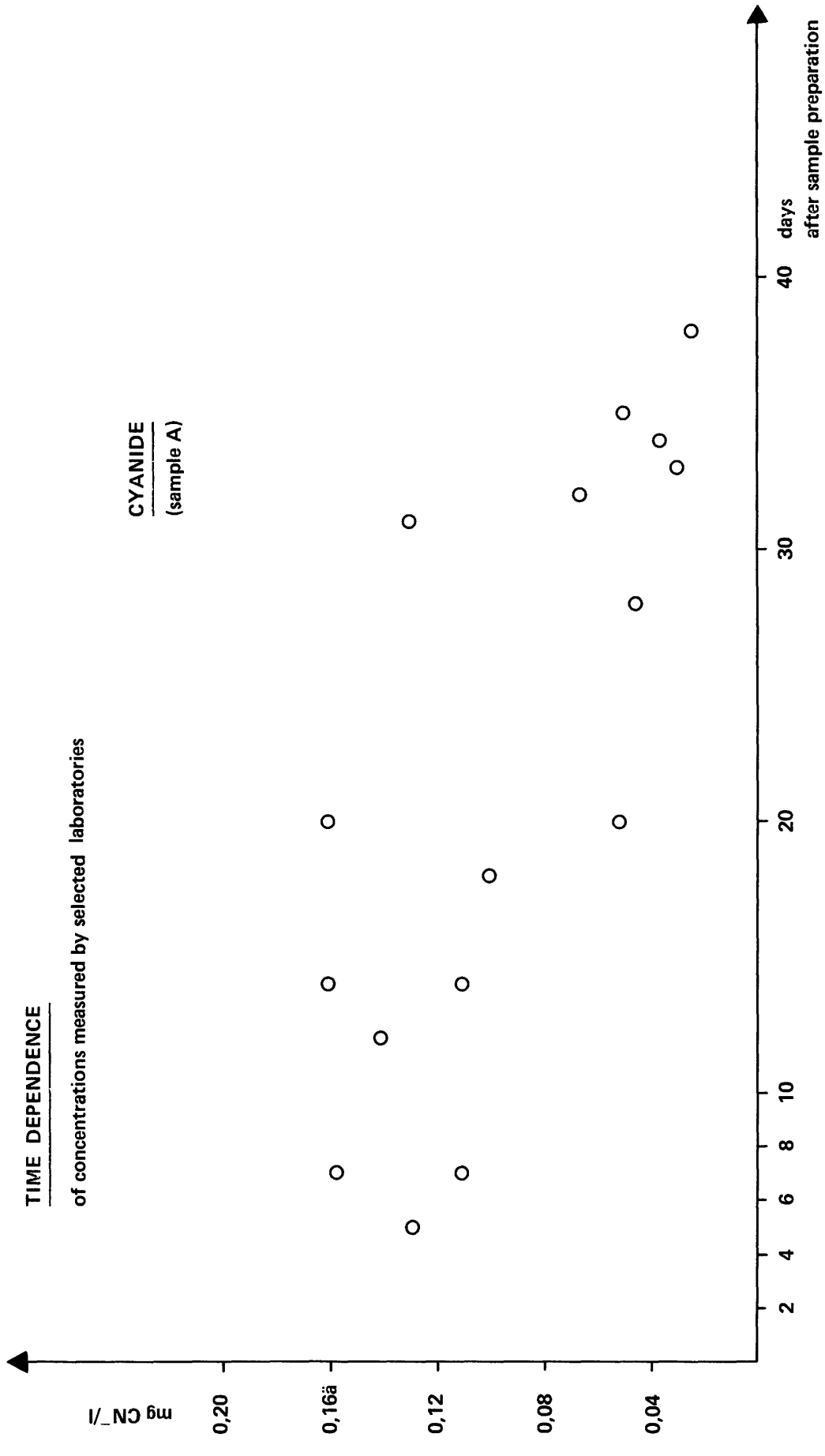
9.3.

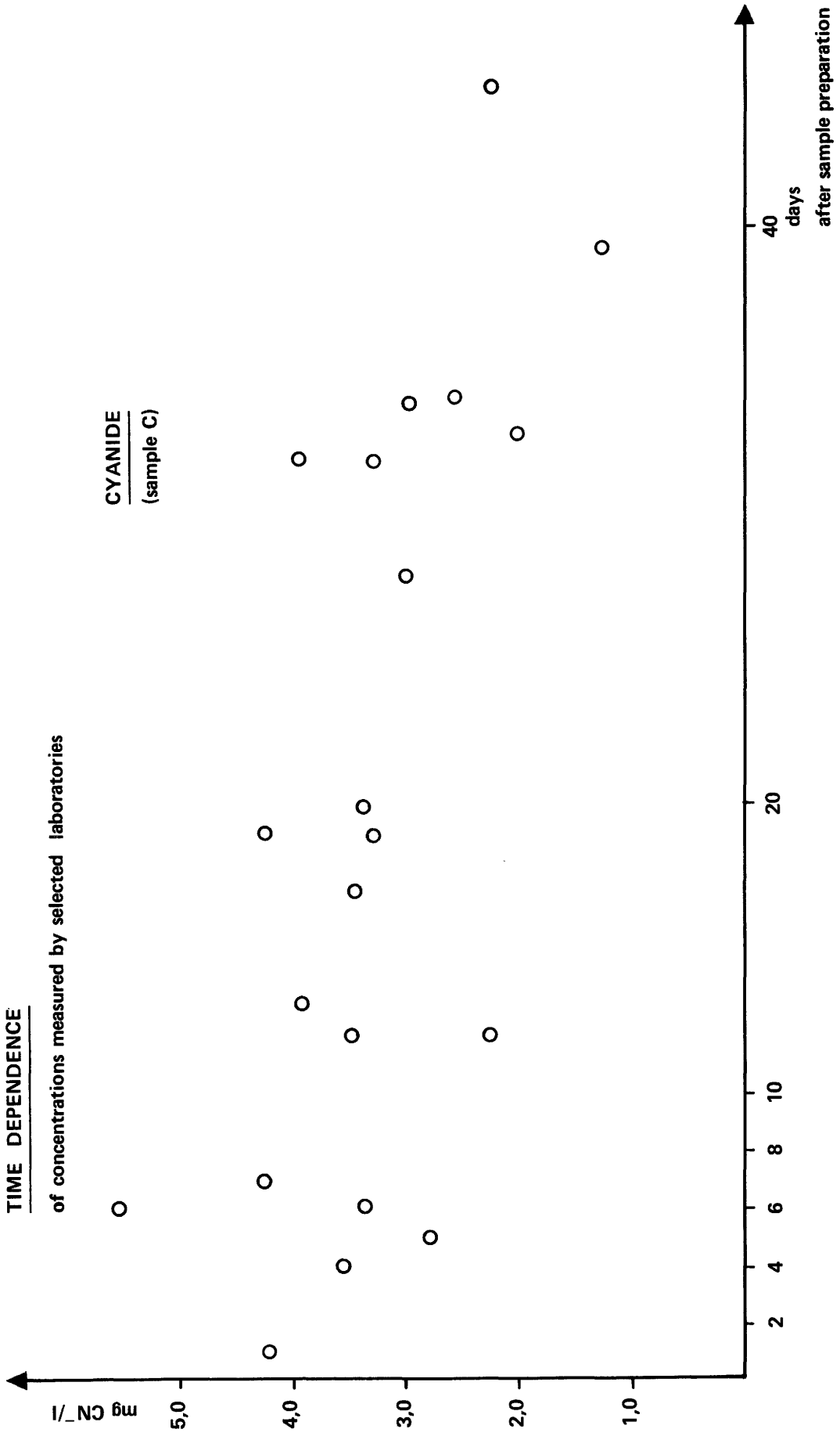

PHENOLS (Sample C)
15,8
15,2
14,1
mg phenol /l
10,0
8,0
6,0
4,0
2,0
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h
laboratory code no.

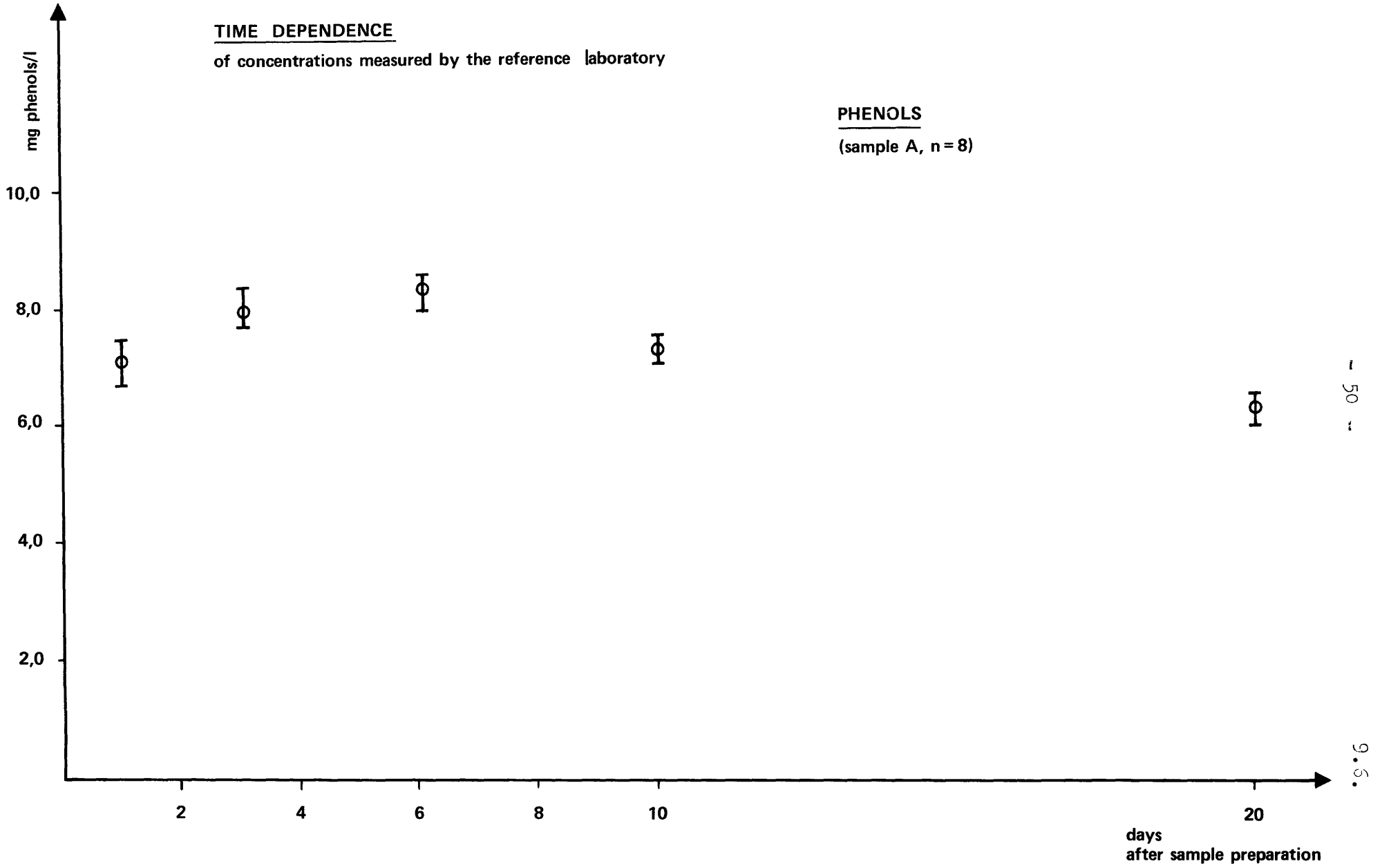
9.4.

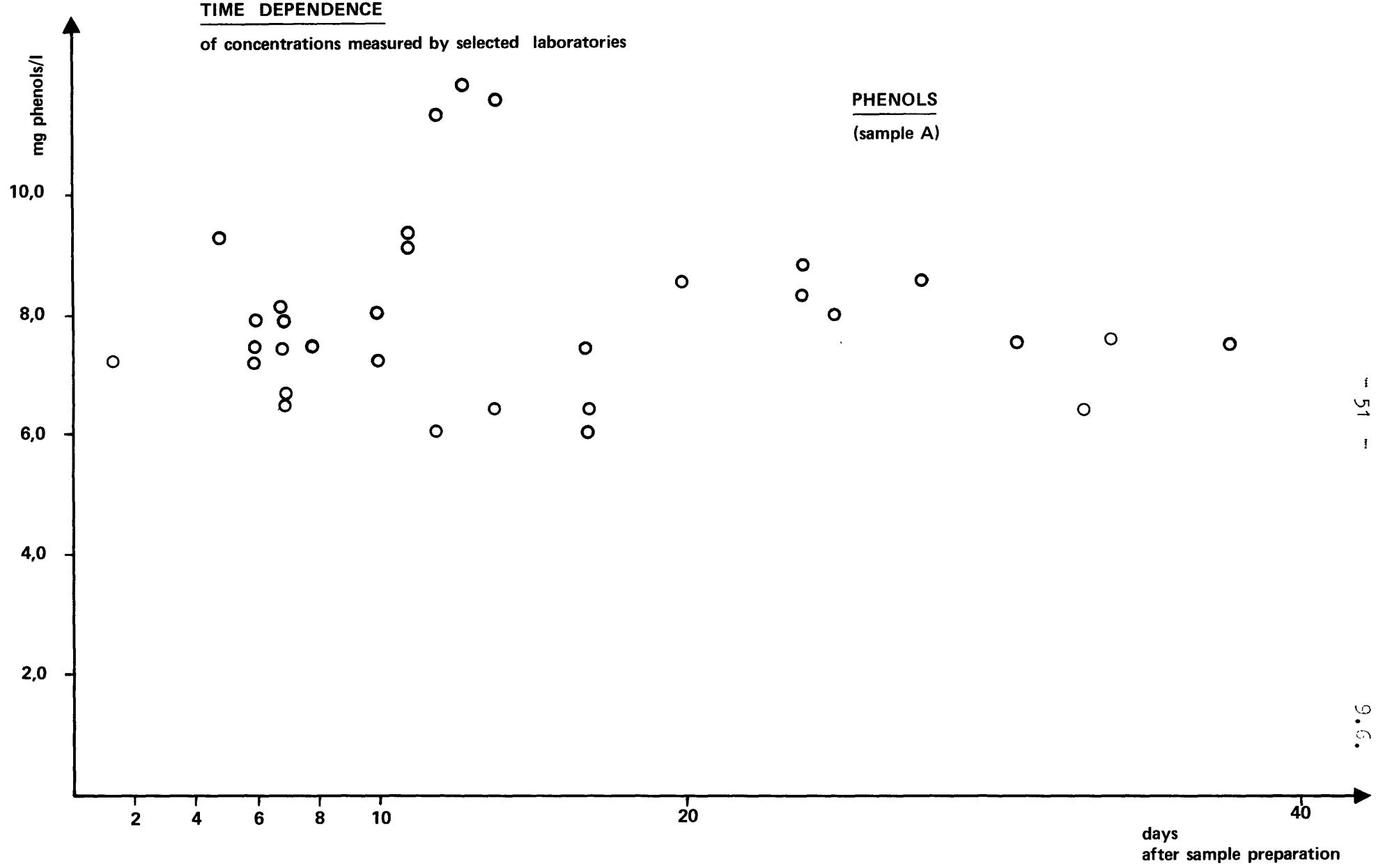

TOTAL ORGANIC CARBON
Sample A
Sample B
Sample C
mg C/l
50
45
40
35
30
A U Y e f g
laboratory code no.
a)
b)

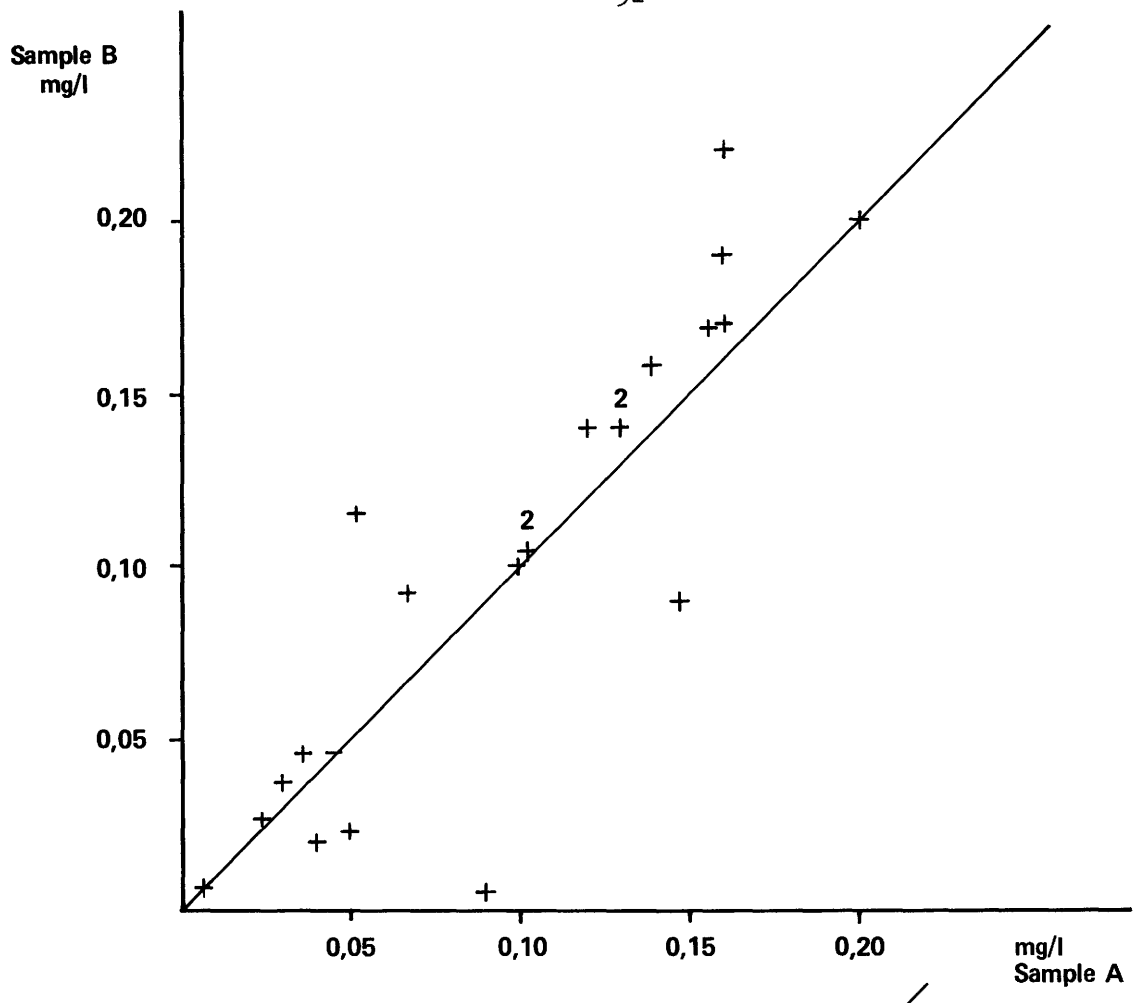

Aliphatic HYDROCARBONS
Sample A
Sample B
Sample C
mg C/l
5,0
4,0
3,0
2,0
1,0
14,2
12,8
11,3
12,2
11,6
10,9
11,4
8,06
4,73
a)
b)
B C E G H K L M N O Q S V f h
laboratory code no.


TIME DEPENDENCE
of concentrations measured by selected laboratories
CYANIDE
(sample A)
mg CN⁻/l
0,20
0,16ä
0,12
0,08
0,04
2
4
6
8
10
20
30
40
days
after sample preparation


TIME DEPENDENCE
of concentrations measured by selected laboratories
CYANIDE
(sample C)
mg CN⁻/l
5,0
4,0
3,0
2,0
1,0
2
4
6
8
10
20
40
days
after sample preparation


TIME DEPENDENCE
of concentrations measured by the reference laboratory
PHENOLS
(sample A, n = 8)
mg phenols/l
10,0
8,0
6,0
4,0
2,0
2
4
6
8
10
20
days
after sample preparation


TIME DEPENDENCE
of concentrations measured by selected laboratories
PHENOLS
(sample A)
mg phenols/l
10,0
8,0
6,0
4,0
2,0
2
4
6
8
10
20
40
days
after sample preparation



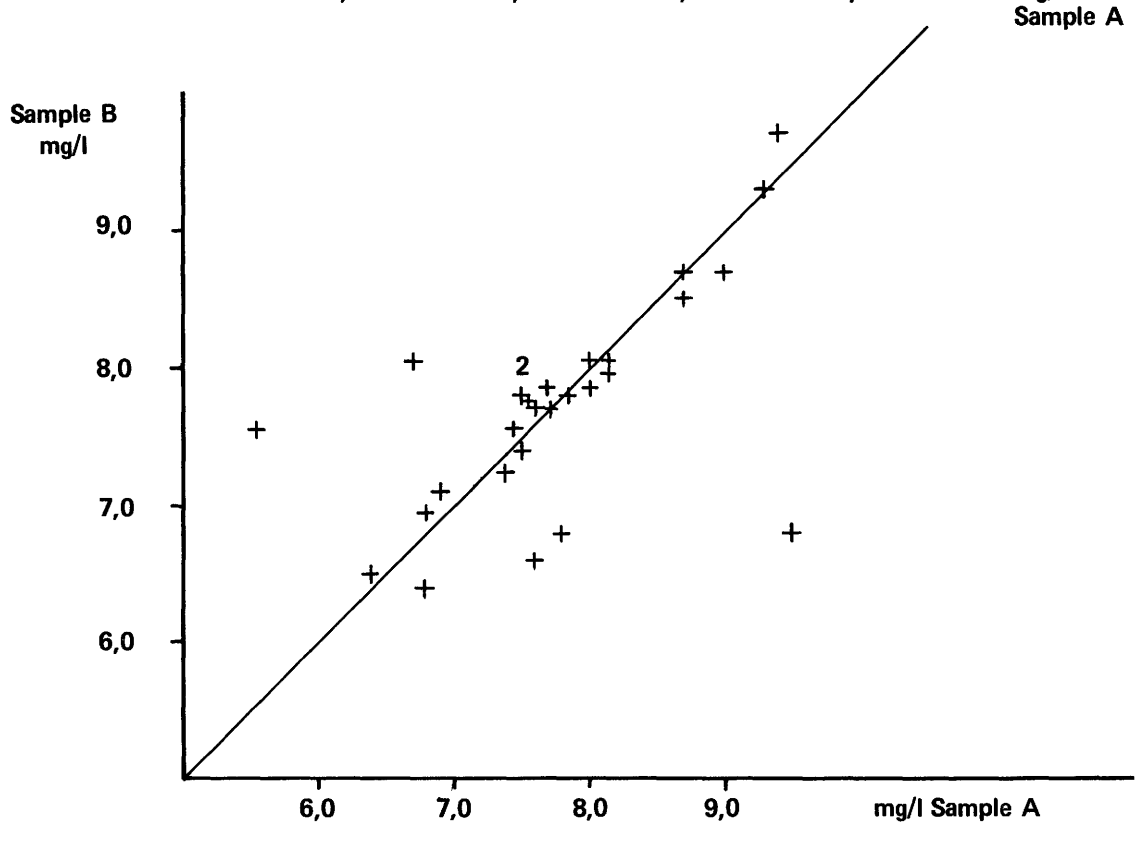


Fig. You den plot for samples A and B
a) Cyanides b) Phenols

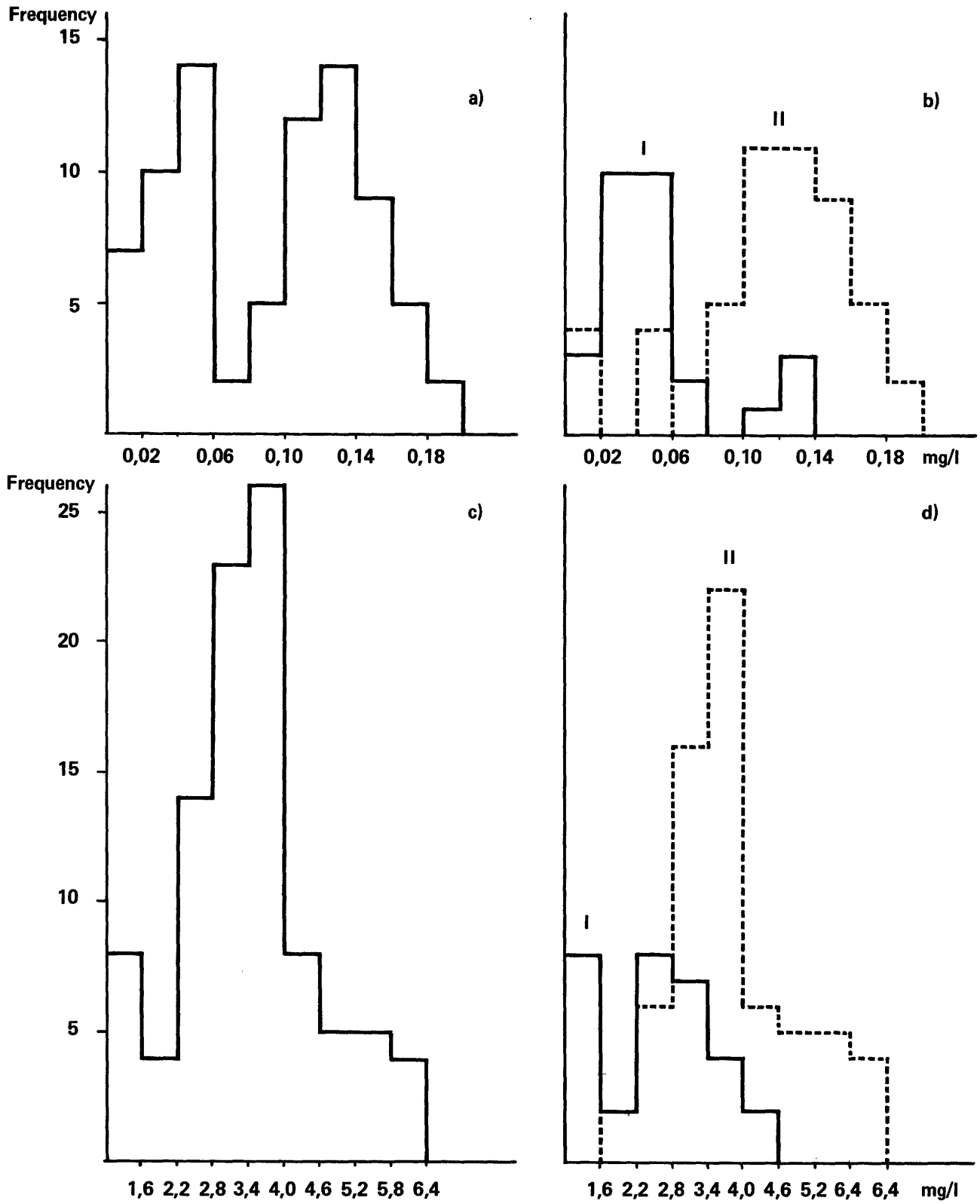


Fig. Frequency distribution of individual detominations of cyanides. a) Sample A. b) Sample A split into two subgroups I and II. c) Sample C. d) Sample C split into two subgroups I and II

Page

10. Appendices

Directorate General
for Social Affairs

Health Protection
Directorate

Luxembourg, 17 June 1974
VDV/jn

Environment and Consumer
Protection Service

EXPLANATORY NOTE

on

A COLLABORATIVE EXERCISE ON THE DETERMINATION OF CYANIDE - PHENOLS AND HYDROCARBONS IN SURFACE WATER SAMPLES

I. In response to the wish expressed by the national experts at the meeting of 22 - 23 Jan. 1974, the Health Protection Directorate of the Directorate General for Social Affairs in collaboration with the Environment and Consumer Protection Service of the C.E.C. are organizing a collaborative exercise in regard to the quantitative measurement of cyanides, phenols and hydrocarbons in surface water samples. The aim of this programme is to investigate on Community level the comparability of measurement of results in order to facilitate the objective evaluation on a common base of the health hazards involved.

II. The samples will be sent to the laboratory interested to participate at this exercise, not later than the beginning of September. The results have to be returned before the 5th of October. The discussion of results will take place in a meeting with the participating laboratories in Luxembourg on the 4th and 5th November 1974.

III. Each sample will consist of 3 x 2 litres.

Sample "A" Synthetic "surface water" with unknown composition
Sample "B" Surface water with unknown composition
Sample "C" Surface water spiked with cyanide, phenols, hydrocarbons.

The three samples will be stabilised with NaOH (pH 11) to ensure conservation for cyanides and phenols.

You will be advised by telex of the date of flight sending the samples so as to be able to get them as soon as possible.

Because we know that transport over a long period of time could cause modifications in waters and dispersions of results, to obtain the most comparable results possible, please take care of additional parameters:

1) Control T° on reception: thermometer enclosed with the bottles in the box
2) Note the date of reception
3) Note exact date of analysis
4) Standard form for transmission of results will be enclosed in each box of samples.

IV. We kindly request the laboratories to closely adhere to the following points:

1) Each sample shall be investigated in quadruplicate (but minimum duplicate) i.e. starting from four separate samplings and analyzed by the same experienced worker for cyanides, phenols, hydrocarbons.
2) The results must be reported in mg/l without averaging.

The results should be sent before 5 October 1974 to:

Prof. Dr. K. AURAND
Institut für Wasser-, Boden- und Lufthygiene
des Bundesgesundheitsamtes
1000 Berlin 33
Postfach (B.R.D.)

using a standard form supplied.

S. JOHNSON

Environment and Consumer
Protection Service
C.E.C.
200, rue de la Loi
BRUXELLES (Belgique)

Dr. J. SMEETS

Division Environmental Hygiene
Health Protection Directorate
C.E.C.
Centre Louvigny
LUXEMBOURG (G.D.)

ANNEX I : Participants formular

ANNEX I

PARTICIPANTS FORMULAR

Our laboratory agrees to participate to the intercomparison programme "CYANIDE, PHENOLS and HYDROCARBONS in surface water samples"

- Name of Laboratory

- Address

- Telephone

- Person to contact

After compiling this, please send back to:

Dr. J. SMEETS

Division Environmental Hygiene
Health Protection Directorate
C.E.C.
Centre Louvigny
LUXEMBOURG (G.D.)

10.2. Note enclosed in the sample boxes

Prof. Dr.K. Aurand
Dr. M. Sonneborn
im
Institut für
Wasser-, Boden- und Lufthygiene
des Bundesgesundheitsamtes

Berlin-Dahlem, den 26.Aug.1974
Corrensplatz 1

To all participants of the Cyanides, Phenols and Hydrocarbons Quality Control

Re: Collaborative Exercise on the Determination of Cyanide, Phenols and Hydrocarbons in Surface Water Samples

The Commission of the European Communities, Luxembourg, has charged us with the technical performance of above mentioned study, and we hereby like to thank you once more for your readiness of participating in this exercise. Having informed you first by Explanatory Note of June 17th, 1974, we send you today the samples to be studied.
Each sample will consist of 3 x 2 litres.

The three samples are stabilised with NaOH (pH 11) to ensure conservation for cyanides and phenols.

Please take note of the following parameters:

1) Control maximum temperature during transport on reception. You will find a maximum-thermometer in the box enclosed with the bottles
2) Note date of reception
3) Note exact date of analysis
4) Please send the results of your analysis - without any corrections - in the standard form, enclosed in the box, up to October 5th, 1974.

The standard form of the results should be sent to

Prof. Dr. K. Aurand
Dr. M. Sonneborn
Institut für Wasser-, Boden- und Lufthygiene
des Bundesgesundheitsamtes

1 Berlin (W) 33
Corrensplatz 1

5) Each sample should be investigated in quadruplicate (but minimum duplicate) i.e. starting from four separate samplings and analysed by the same experienced worker for cyanides, phenols and hydrocarbons.

6) On receipt of the samples, moreover we kindly ask you to immediately send us in advance enclosed post card with the following datas:

I.) Date of arrival of the samples at your laboratory: .....
II.) Maximum temperature during transport on receipt: .....

Standard Form for Results of the collaboratory study in EC-frame work on the determination of Cyanide, Phenols and Hydrocarbons

Code N° of the laboratory

	Sample A				Sample B				Sample C				Calculated and expressed in reference to:
	1)	2)	3)	4)	1)	2)	3)	4)	1)	2)	3)	4)	
Cyanide													mg/l CN^-
Phenols													mg/l C_6H_5OH (o-phenol)
Hydrocarbons													mg/l *)
Date of Analysis													

Remarks: 1) 2) 3) 4): quadruplicate determination, minimum duplicate determination

Results with 2 or 1 decimal places according to your analytical sensivivity

*) C: organic carbon, without any corrections

Maximum of temperature during transport (as registered by the enclosed maximum-thermometer at arrival of the samples):

Date of reception of the samples:

Description of the Methods used and detection limit of the methods (exact description on separate sheets)

10.4.
Code number:

Questionnaire

EG collaborative study: C y a n i d e s

1. Sample pretreatment

   1.1. Treatment before distillation:

   1.2. Distillation:

   1.3. Treatment after distillation:

2. Analytical determination

   2.1. Colorimetric determination:
   Color reagent:
   Incubation time:
   Wave length of measurement:
   Extraction of the color-phase:

   2.2. Ionspecific electrodes:

   2.3. Titrimetric determination:
   Indicator:

   2.4. Other methods:

3. Concentration range (the method is normally used for analysis of water samples):

4. Detection limit:

Code number:

Questionnaire

EG collaborative study: P h e n o l s

1. Sample pretreatment

   1.1. Extraction

   1.2. Distillation:

   1.3. Other methods:

2. Analytical determination

   2.1. Colorimetric determination:
   Color reagent:
   Incubation time:
   Wave length of measurement:
   Extraction of the color-phase:

   2.2. G-L-C:

   2.3. Other methods:

3. Concentration range (the method is normally used for analysis of water samples):

4. Detection limit:

Code number:

Questionnaire

EG collaborative study: H y d r o c a r b o n s

1. Sample pretreatment

   1.1. Extraction:

   1.2. Absorption by Florisil:

   1.3. Other methods:

2. Analytical determination

   2.1. Infrared-spectroscopy:
   Calibration standard:

   2.2. Other methods:

3. Concentration range (the method is normally used for analysis of water samples):

4. Detection limit:

LIST OF LABORATORIES

participating in the intercomparison study

COUNTRY	ADDRESS	NAME OF RESPONSIBLE PERSON
Belgium	"Department Water" Institut d'Hygiène et d'Epidémiologie Ministère de la Santé Publique 14, rue Juliette Wytsman 1050 BRUXELLES	Mr. DE SCHEPPER, H.
	Institut MALVOZ Service d'Hygiène 4, Quai du Barbou 4000 LIEGE	Mr. VAN BENEDEN, P.
	Laboratoire Provincial de Toxicologie du Travail 151 Boulevard de la Constitution 4000 LIEGE	Mr. DELLA FIORENTINA
	Department of Chemistry Universitaire Instelling Antwerpen Universitietsplein 1 2610 WILRIJK	Mr. VAN CAUWENBERGHE, K.
Denmark	Esbjerg Kommune Høgvej 25 6700 ESBJERG	Mrs. ULRICH, G.
	Odense Kommunes Laboratorium 60, Rugårdsvej 5000 ODENSE	Mr. FUNDER-SCHMIDT, B.
France	Institut Municipal de recherches sur l'alimentation humaine et animale Chef du Service Chemie des Eaux Rue Prof. Vezes 33000 BORDEAUX	Mr. FAUGERE, J.G.

COUNTRY	ADDRESS	NAME OF RESPONSIBLE PERSON
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	Société Lyonnaise des Eaux 10, rue de la Liberté 78230 LE PECQ	Mr. BUFFLE
	Institut Pasteur de Lyon 77, rue Pasteur 69365 LYON CEDEX 2	Mr. VIAL, J.
	Laboratoire Société des Eaux de Marseille 25, rue Charles Kaddouz 13012 MARSEILLE	Mr. BOSSY, G.
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	Laboratoire d'Hygiène de la Ville de Paris Ministère de la Santé Publique 1 bis, rue des Hospitalières St. Gervais 75004 PARIS	Mr. FESTY, B
	Service de Contrôle des Eaux Laboratoire de Contrôle des Eaux de la Ville de Paris 144 Av. Paul Vaillant Couturier 75014 PARIS	Mr. MONTIEL, A.
	Laboratoire de chimie Ecole Nationale de la Santé Publique Avenue du Prof. Léon-Bernard 35043 RENNES CEDEX	Mr. NEVEU, M.

COUNTRY	ADDRESS	NAME OF RESPONSIBLE PERSON
	Institut Français du Pétrole 1 et 4 Av. du Bois Préau 92502 RUEIL MALMAISON	Mr. GATELLIER
	I.R.CH.A. - Ministère du Développement Industrie et Scientifique B.P. n° 1 91710 VERT-LE-PETIT	Mr. CABRIDENC, R
Germany	Ruhrverband und Ruhrtalsperrenverein Chemisches und biologisches Laboratorium Kronprinzenstr. 37 43 ESSEN 1	Mr. KOPPE Mr. DIETZ
	Institut für Wasser-, Boden- und Lufthygiene des Bundesgesundheitsamtes Kennedyallee 97 6 FRANKFURT/MAIN	Mrs. MUHLE, A.
	Bundesanstalt für Gewässerkunde Kaiserin Augusta-Anlage 15 5400 KOBLENZ	Mr. KLEIN, K.
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Italy	Laboratorio Provinciale d'Igiene e Profilassi Reparto Chimico Via Ponte alle Mosse no. 211 FIRENZE	Mr. BIFFOLI, R.
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COUNTRY	ADDRESS	NAME OF RESPONSIBLE PERSON
	Istituto Superiore di Sanità Laboratori Chimici - Reparto acque 299, Via Regina Elena R O M A	Mr. DE FULVIO, S.
	Istituto Ricerca sulle acque Via Reno 1 R O M A	Mr. PASSINO, R.
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The Netherlands	Rijksinstituut voor de Volksgezondheid Postbus 1 BILTHOVEN	Mr. FONDS
	Rijksinstituut voor Drinkwatervoorziening Parkweg 13 's GRAVENHAGEN - DEN HAAG	Mr. ZOETEMAN, C.
	Rijksinstituut voor de Zuivering van Afvalwater Westeinde 3a VOORBURG	Mr. BAAIJ, P.K.
United Kingdom	Anglian Water Authority Essex River Division Laboratory Rivers House, Springfield Road CHELMSFORD - Essex	Mr. EASTMAN, G.M.
	Regional Laboratory Severn-Trent Water Authority St. Martin's Road FINHAM-COVENTRY CV3 6 PR	Mr. LEWIS, W.M.

COUNTRY	ADDRESS	NAME OF RESPONSIBLE PERSON
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	Anglian Water Authority Diploma House Grammar School Walk RUNTINGDON	Mr. DAVIES, A.W.
	North West Water Authority Dawson House Great Sankey WARRINGTON - Lancs. WA2 8 JD	Mr. AINSWORTH, G.

LIST OF EXPERTS

participating in the meeting Luxembourg, 4th - 5th Nov., 1974

COUNTRY	ADDRESS	NAME
Commission of the European Communities	C.C.E. Service Environnement et Protection des Consommateurs Bât. Archimède, 25 BRUXELLES (Belgique)	Mr. VACCAREZZA, J.
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	C.C.E. Direction Protection Sanitaire Centre Louvigny LUXEMBOURG (G.D.)	Mr. BONINI, A.
	C.C.E. Direction Protection Sanitaire Centre Louvigny LUXEMBOURG (G.D.)	Mr. SMEETS, J. Chairman
	C.C.E. Direction Protection Sanitaire Centre Louvigny LUXEMBOURG (G.D.)	Mrs. VAN DER VENNE, M.Th.
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	Odense Kommunes Laboratorium 60, Rugårdvej 5000 ODENSE	Mr. FUNDER-SCHMIDT
France	Laboratoire Municipal Chef du Service Chimie des Eaux Rue Prof. Vezes 33000 BORDEAUX	Mr. BARDY, J.
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	Institut für Wasser-, Boden- und Lufthygiene des Bundesgesundheitsamtes Corrensplatz 1 1 BERLIN 33	Mr. LESCHBER, R.
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Italy	Laboratorio Provinciale d'Igiene e Profilassi Reparto Chimico Via Ponte alle Mosse No. 211 FIRENZE	Mr. BIFFOLI, R.
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Luxembourg	Ministère de la Santé Publique Institut d'Hygiène et de Santé Publique Laboratoire des Eaux la, rue Auguste Lumière LUXEMBOURG	Mr. HANSEN, P.
The Netherlands	Rijksinstituut voor Drinkwatervoorziening Parkweg 13 DEN HAAG	Mr. BRINKMANN, F.J.J.
	Rijksinstituut voor de Volksgezondheid Antonie v. Leeuwemhoeklaan 9 UTRECHT	Mr. REYNNERS, H.
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	Anglian Water Authority Essex River Division Laboratory Rivers House, Springfield Road CHELMSFORD/Essex	Mr. EASTMAN, G.M.
	Regional Laboratory Severn-Trent Water Authority St. Martin's Road FINHAM / COVENTRY CV3 6 PR	Mr. LEWIS, W.M.
	North West Water Authority Drawson House Great Sankey WARRINGRON / Lancs WA2 8 JD	Mr. ATKINSON, J.W.

11. Selected Literature (cit. by the participating Laboratories)

11.1. Cyanides

Bark, L.S. et al.: Analyst 88 (1964)

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Epstein, J.: Anal. Chem. 19, 272 (1947)

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Analysis of Raw, Potable and Waste Waters,
Department of the Environment, London (1972)

Deutsche Einheitsverfahren zur Wasseruntersuchung,
Ges. Deutscher Chemiker, Weinheim (1973)

Dutch Norm NEN 1056 IV 8

Standard Methods for the Examination of Water and
Wastewater, American Public Health Association,
New York (1971)

11.2. Phenols

Cooper, R.L., et al.: Water research 7, 1375 (1973)

Ettinger, M.B. et al.: Anal. Chem. 23, 1783 (1951)

Martin, R.W.: Anal. Chem. 21, 1419 (1949)

Merck, E. A., Darmstadt: Untersuchung von Wasser, 5.Aufl.

Rodier: L'analyse chimique et physico-chimique de l'eau
(1971)

Association Française de Normalisation
Tour Europe - AFNOR, Paris (1973)

Deutsche Einheitsverfahren zur Wasseruntersuchung,
Ges. Deutscher Chemiker, Weinheim (1973)

Standard Methods for the Examination of Water and Wastewater, American Public Health Association, New York (1971)

11.3. Hydrocarbons

Association Française de Normalisation
Tour Europe - AFNOR, Paris (1973)

Deutsche Einheitsverfahren zur Wasseruntersuchung,
Ges. Deutscher Chemiker, Weinheim (1973)

Specific descriptions of the methods used by the participating laboratories are compiled at the Health Protection Directorate, European Communities, Luxembourg.