KWR | November 2019

KWR Proficiency Testing Services Program for 2020

KWR

Bridging Science to Practice

KWR Proficiency Testing Services Program for 2020

KWR | November 2020

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Content

1 Introdution

1.1 General

KWR Water Research Institute, hereinafter abbreviated as KWR, is the competence centre for water and related nature and environmental aspects. It covers the entire area from catchment, treatment and distribution to the quality assessment of drinking, industrial, waste and domestic water. KWR supports water companies and third parties at home and abroad with research in the area of (drinking) water, water quality and water management.

Furthermore, KWR organizes proficiency tests for the matrix water. These proficiency tests are an important instrument in the harmonization of (environmental) analyses within The Netherlands as well as within Europe. The importance of proficiency testing for individual laboratories lies in the opportunity to compare own results with those from other (peer) laboratories. In practice, different analytical methods are being used and suitable reference materials are not always available. Therefore, it is sometimes impossible for laboratories to determine if (systematic) errors are present in their analytical procedures. Proficiency testing results can be helpful in visualizing these types of errors. Good results of a laboratory in a proficiency test can give additional value and trust towards customers and can play an important role in the assessment of the laboratory by accreditation bodies. Therefore, proficiency testing is more and more considered as a standard and integral part of the quality control system of a laboratory, by laboratories as well as accreditation bodies. For participants it is of utmost importance that the quality of the offered proficiency testing service is outstanding. Accrediting the organization of proficiency testing schemes is a tool to guarantee high quality schemes.

Depending on the objective, different types of proficiency tests can be organized. They can be divided into three types:

- method-evaluating test comparisons in which the performance of a (newly) developed method is tested;
- material-certifying test comparisons that primarily involve the production of a certified reference material for quality control purposes;
- laboratory-evaluating test comparisons (also called proficiency tests) that give participating laboratories the opportunity to evaluate their analytical methods and to compare their results with those from other (peer) laboratories.

1.2 KWR proficiency testing

Especially for the laboratory-evaluating comparisons KWR has set up a yearly program, which enables laboratories to test and evaluate their laboratory procedures on a regular basis. The primary objective of a proficiency test is to create an opportunity for laboratories to test their own performances under analytical conditions which are as normal as possible. To enable laboratories to get insight into their own performance in daily practice, they will receive samples which are made of practice water matrices. The analytical method to be applied by the laboratory is up to the laboratory, no mandatory methods are demanded by KWR. Assessment of the KWR Proficiency Testing Services by an independent institute, The Dutch Council for Accreditation, took place in 1996. Since thereon the complete package of KWR inter-laboratory test comparisons has been accredited and is registered under number R005. This accreditation according ISO/IEC 17043:2010 ensures participants that aspects such as high quality samples (homogeneous, stable, compatible with matrices offered in practice), suitable statistics, clear reports and impartiality of the organizer is guaranteed.

KWR proficiency tests:

- consist yearly of approximately 40 laboratory test comparisons for different types of water and more than 250 parameters;
- are based on Youden statistics for chemical parameters, which makes it possible to obtain a good indication if deviating results are caused by systematic and/or by relatively large random errors;
- present the results in table format and graphically;
- give information about the analytical methods applied by the participants. In this way assessment of the participants performance is simplified;
- assess the performance for chemical parameters of a group of (peer) laboratories by presenting a report mark;
- assess the individual performance of a laboratory by presenting the z-score.

In this brochure the procedure to be followed, when participating in KWR proficiency tests, is described. In chapter 2, the practical side of participating (subscription, sample distribution and receipt, reporting, etc.) is explained. The proficiency-testing program for 2020 together with the subscription form can be found in chapters 3, 4 and 5. In chapter 6 an extended explanation of the layout and statistics of the KWR proficiency tests is given.

2 General information

2.1 Subcription

This brochure contains the program for the KWR proficiency tests for 2020. You can make your own selection from several proficiency tests offered by ticking the appropriate box(es) on the subscription form. In this way you can put together a tailor-made program.

All participants receive after registering a written confirmation of participation.

For the chemical and microbiological proficiency tests you may have different contact persons. If so, you can let us know by filling out the subscription form or by phoning us. You will also receive a set of keys to open the (cooling) containers. These keys remain in your possession for as long as you participate in the KWR scheme.

Finally, you will receive an instruction for entering and reporting your analysis results of a proficiency test.

2.2 Per proficiency test

KWR offers you for every parameter an opportunity to test your own performances under analytical conditions that are as normal as possible. To enable you to get insight into your own performance in daily practice, you will receive samples which are made from real drinking water, surface water, ground water, waste water or swimming water. Furthermore, for a number of chemical proficiency tests you will also receive standard solutions to check your instruments directly. It is, of course, important that you treat the proficiency testing samples the same as any other sample that is offered to your laboratory for analysis. In this way your results in the inter-laboratory test comparison represent daily practice and you will get the most out of your participation. For each proficiency test wherein you subscribe you will receive an e-mail with two accompanying files: a form to fill in your results and an instruction with the details.

This instruction refers to:

- the parameters to be analysed;
- an indication of the concentration levels;
- the matrices offered;
- the preservation of the samples (where applicable samples will be cooled during transportation);
- an advice relating to the storage life of the samples;
- the code numbers on the sample bottles;
- when to report back your results (closing date of the Proficiency Test) and how to
- return the packaging materials;
- the date when you can expect to receive the final report from KWR;
- any other information that could be of importance.

Results as well as applied analytical methods will be reported under a random code number in the final report.

2.3 Sample material

The amount of sample material you will receive is based on the amount that is needed when using an accepted analytical method. If you require more sample material than provided, you may contact Mrs M. ten Broeke. She is also the person to contact when the sample material has been damaged during transport. If possible, you will then immediately receive new sample material.

It is also possible to request additional sample material for other purposes (internal quality assurance). However, we are then forced to charge extra costs for preparation and shipping.

2.4 Distribution of the samples and returning of packaging materials

The microbiological samples and proficiency tests which contain parameters with a limited storage life, they will be delivered before 12:00 hours after receipt of the samples and you can return the packaging materials by postal mail (preferably within two weeks after receiving the samples). Samples delivered outside the Netherlands and Belgium will arrive later.

2.5 Reporting your results

The files with your results and applied analytical methods (for verification purposes we also ask you to send a print out on paper) have to be at KWR within 4 weeks (for chemical Proficiency Tests) or within 3 weeks (for microbiological proficiency tests) after receiving the samples. The exact closing date stated in the instruction of the proficiency test. For delivering the results you need to use the RingDat Online program.

2.6 Reporting by KWR

The objective is four weeks after the closing date to send to you by e-mail the final report and the summary for all proficiency tests. In the KWR proficiency tests the results and analytical methods applied of all participants will be reported under a random code number to guarantee anonymity. A list of participants is given in the final report. If you do not want your company to be named in this list, it is possible to be named under code, which you can let us know by phone or by letter. The overview of analytical methods applied, given in the final report, can be of use in assessing deviating results. The results of the whole group of participants for the chemical proficiency tests is assessed in a so-called 'report mark'. In general one report mark is given per parameter and per matrix.

An individual assessment of the performance of each participant is given through reporting of the z-scores. Z-scores are calculated in relation to the group average and in relation to the theoretical value. In this way you can follow your own performance. The final report displays the results graphically and in table format. The report also contains a summary of your results. We refer to chapter 6 for an extended explanation of the lay-out, applied statistics and the report.

2.7 Information

For further information and requests, please contact:

- Asmaïl Asgadaouan (phone: +31 (0)30 60 69 595), e-mail: Asmail.Asgadaouan@kwrwater.nl
- Marieke ten Broeke (phone: +31 (0)30 60 69 612), e-mail: Marieke.ten.Broeke@kwrwater.nl
- Send an email to: pt@kwrwater.nl

3 Program 2020

3.1 How to make a choice

The KWR program consists of organic, inorganic and microbiological inter-laboratory test comparisons for more than 250 physical, chemical and microbiological parameters in the matrices drinking, surface, ground, waste and swimming water. By offering this program we hope that we can be of service to you in setting up your own personal proficiency testing program in 2020.

3.1.1 Inorganic parameters

For the tests VIO 20-06 (urea, cyanuric acid, free chlorine, total chlorine and $KMnO_4$ in swimming water) we offer you also standard solutions.

3.1.2 Organic parameters

In every organic proficiency test at least three matrices are offered and one standard solution. Per matrix two spiked samples are offered, excepted the proficiency test mineral oil in waste water (VIO 20-38).

3.1.3 Microbiological parameters

For all the microbiological proficiency tests, excepted the parameters SSRC and *Clostridium perfringens*, we offer four samples.
For the proficiency tests *Legionella pneumophila* qPCR beside the water samples two genomic DNA standards are sent.

3.2 Changes in the program 2020

The program KWR proficiency tests for 2020 relative to previous years, some changes have been made.

- At the chemical proficiency tests:
  - The PTs “arsenic-3, arsenic-5, chromium-3 and chromium-6”, “odour and flavour” and “AOX” were **not** included in the annual program due to insufficient interest.
  - The PT VIO 20-21 (EOX) is **only** offered in the matrices surface and waste water.
  - The PT VIO 20-39b (non target screening) is **only** offered in the matrices surface and drinking water.
  - The PT VIO 20-17 (sampling on location) has been expanded with laboratory analyzes urea, $KMnO_4$ and pH.

- At the microbiological proficiency tests:
  - The concentration ranges for the bacteriological parameters in PTs (VIO 20-41, VIO 20-42, VIO 20-43 and VIO 20-50) and *Legionella* in cooling water (VIO 20-55 and VIO 20-56) have been expanded.
  - The PT VIO 20-48 is only offered for the parameter ATP. Colonies on R_2A-medium has been removed due to insufficient interest.

  - Also this year, the following proficiency tests are optional included in the program and will only proceed if there are sufficient participants. If you register for one of these proficiency tests, you will be automatically enrolled in one of the other similar proficiency tests:
    - VIO 20-42: microbiologcal parameters in drinking water (plan date: June 9, 2020);
    - VIO 20-46: *Legionella* in drinking water (plan date: May 13, 2020);
    - VIO 20-54: microbiological parameters in surface water (plan date: September 23, 2020);
    - VIO 20-56: *Legionella* in cooling water (plan date: September 2, 2020).

3.3 Order confirmation and invoice

Based on your subscription form we will calculate the costs and send you an overview of your participation. The total costs will be invoiced twice a year in two equal amounts, unless other agreements are made with you. If changes in your order occur during the year, an adapted cost accounting will be handled in the second period.

3.4 Discounts

At participating in several proficiency tests the following discounts are given:

Participation in 5-9 proficiency tests:	5% discount
Participation in 10-19 proficiency tests:	10% discount
Participation in more than 20 proficiency tests:	15% discount

The prices in the program are excluding carriage costs. Transport costs, based on actual transportation costs by post-calculation, will be charged.

The General Terms and Conditions for the Supply of Goods and Provision of Services and Purchase placed with KWR Water Research Institute are applied on this tender. You can find this on KWR website www.kwrwater.nl/voorwaarden/.

3.5 Cancelling an order

If you wish to cancel a collaborative study, you need at least four weeks before the date of receipt of the collaborative study notify us in writing. After this period the cost of the ring test will be charged.

3.6 KWR PT program 2020 and subscription form

On pages 12 to 18 you will find our detailed program and on pages 19 and 20 the subscription form for 2020.

You can subscribe for the KWR proficiency tests by using the subscription form. Please do this at least four weeks before the starting date of the proficiency tests.

The subscription form can be sent to:
KWR Water Research Institute
Attn.: Marieke ten Broeke
P.O. Box 1072
3430 BB NIEUWEGEIN
The Netherlands
FAX: (+31) 30 60 611 65
E-mail: Marieke.ten.Broeke@kwrwater.nl of pt@kwrwater.nl

When less than eight participants subscribe, KWR reserves the right to cancel the proficiency test.

4 Overview KWR Proficiency Tests 2020

Date	PT code	Matrix	Description
29 January	VIO 20-21	sw+ww	extractable organic halogens (EOX)
5 February	VIO 20-02	dw	◊ general- and macro parameters
11 February	VIO 20-41	dw	◊ microbiological parameters
4 March	VIO 20-30	dw+sw+gw	herbicides
11 March	VIO 20-06	zw	◊ urea, cyanuric acid, free chlorine, total chlorine, $KMnO_4$
11 March	VIO 20-45	dw	◊ *Legionella*
11 March	VIO 20-55	kw	◊ *Legionella* (only according to NEN-EN-ISO 11731)
11 March	VIO 20-59	dw	◊ *Legionella pneumophila* qPCR
11 March	VIO 20-61	kw	◊ *Legionella pneumophila* qPCR
18 March	VIO 20-25	dw+sw+gw+ww	polycyclic aromatic hydrocarbons (PAH)
25 March	VIO 20-48	dsw+dw	◊ ATP (Adenosine Tri Phosphate)
25 March	VIO 20-62	dw	◊ F-specific RNA-phages and Somatic coli-phages
25 March	VIO 20-63	dw	◊ total bacterial cell counting (incl. fraction dead and alive) using a flowcytometer
8 April	VIO 20-07	sw	◊ nutrients
8 April	VIO 20-18	dw+sw	bromide, bromate and chlorate
8 April	VIO 20-28	dw+sw+gw	pharmaceuticals
8 April	VIO 20-34	dw+sw+gw	glyphosate and AMPA
13 May	VIO 20-01	dw	(heavy) metals, as dissolved
13 May	VIO 20-09a	sw	(heavy) metals, as total
13 May	VIO 20-12	gw	(heavy) metals, as dissolved
13 May	VIO 20-46#	dw	◊ Legionella
27 May	VIO 20-23	dw+sw+gw+ww	pesticides (OCP)
27 May	VIO 20-24	dw+sw+gw	pesticides (PCB)
9 June	VIO 20-42#	dw	◊ microbiological parameters
17 June	VIO 20-31	dw+sw+gw	chlorophenoxycarbonic acids (CPCA)/bentazone
23 June	VIO 20-53	sw	◊ microbiological parameters
24 June	VIO 20-17	zw	sampling swimming water on location in The Netherlands
2 September	VIO 20-26	dw+sw+gw+ww	volatile halogenated hydrocarbons (VHH)
2 September	VIO 20-47	dw	◊ *Legionella*
2 September	VIO 20-56#	kw	◊ *Legionella* (only according to NEN-EN-ISO 11731)
9 September	VIO 20-50	dw	◊ *Salmonella*, *Pseudomonas aeruginosa*, staphylococci
23 September	VIO 20-39b	dw+sw	non-target screening, semi-quantitative using a LC-MS
23 September	VIO 20-54#	sw	◊ microbiological parameters
7 October	VIO 20-27	dw+sw+gw+ww	volatile aromatic hydrocarbons (VAH)
13 October	VIO 20-43	dw	◊ microbiological parameters
14 October	VIO 20-15	ww	◊ general- and macro parameters
14 October	VIO 20-16	ww	(heavy) metals, as total
4 November	VIO 20-13	gw	◊ general- and macro parameters
4 November	VIO 20-32	dw+sw+gw	phenylureaherbicides (PUH)
4 November	VIO 20-38	ww	mineral oil
17 November	VIO 20-20	sw	sampling surface water on location in The Netherlands

 # This proficiency test is optional. Only if there are enough participants this test will go on.
◊ Proficiency tests marked with this symbol contain parameters that are only stable for 24 hours. Subscription to these tests may be possible after consulting Mrs M. ten Broeke. (See previous page for her contact data).

ww = waste water, dw = drinking water, gw = groundwater, kw = cooling water, sw = surface water, dsw = diluted surface water and zw = pool water

5 Parameter specifications per proficiency test

5.1 General- and inorganic parameters and (heavy) metals

Date	PT code	Parameter	Matrix	Concentration range	
13 May	VIO 20-01#	**(Heavy) metals, as dissolved:**			
		Hg,		0,1-1	µg/l
		Ag*, Be*, Cd, Co*, V*,		0,1-10	µg/l
		Al, As, Cr, Pb, Sb, Se, Sr*,		1-70	µg/l
		Cu, Ni, Zn,	dw	1-200	µg/l
		B, Ba, Fe, Mn, Mo*,		1-350	µg/l
		K, Mg,		0,5-50	mg/l
		Ca, Na,		1-200	mg/l
		total hardness.		0,5-6	mmol/l
5 February	VIO 20-02	NO_2,		0,02-0,2	mg N/l
		F,		0,05-2	mg/l
		NH_4,		0,05-2	mg N/l
		turbidity,		0,1-2,5	FNE
		DOC,		0,1-15	mg C/l
		NO_3,		0,5-50	mg N/l
		SO_4,		1-200	mg/l
		Cl,	dw	10-200	mg/l
		ortho-phosphate, total-phosphate,	**cooled transport**	0,05-2	mg P/l
		pH,		4-11	pH
		SiO_2,		0,1-15	mg Si/l
		colour,		2-20	mg Pt/l
		CO_3,		0,5-50	mg/l
		EGV (25°C),		10-150	mS/m
		HCO_3,		1-300	mg/l
		total cyanide.		2,5-350	µg/l
11 March	VIO 20-06	urea,		0,5-5	mg/l
		cyanuric acid,	zw	5-15	mg/l
		free chlorine, total chlorine,	**cooled transport**	0,1-20	mg/l
		$KMnO_4$*.		0,1-20	mg/l
8 April	VIO 20-07	NH_4, NO_2, NO_3,		0,02-2	mg N/l
		ortho-phosphate,		0,05-3	mg P/l
		anion active detergents,		0,02-2,5	mg/l NalaurylSO$_4$
		F,		0,02-2,5	mg/l
		Kjeldahl-N,		0,05-3	mg N/l
		total-phosphate,	sw	0,02-2	mg P/l
		COD (CZV),	**cooled transport**	1-15	mg O_2/l
		SiO_2,		1-15	mg Si/l
		UV-absorption,		0,1-20	E/m
		colour,		2-20	mg Pt/l
		SO_4, Cl,		1-200	mg/l
		suspended solids,		a.l.	mg/l
		oxygen (dissolved.		1-15	mg O_2/l
13 May	VIO 20-09a#	**(Heavy) metals, as total:**			
		Ag*, Be, Cd, Hg, Sb*,		0,1-10	µg/l
		Al, As, Co, Cr, Pb, Se, Sr*, V,		1-70	µg/l
		B*, Ba, Cu, Mo*, Ni, Zn,	sw	1-500	µg/l
		Fe, Mn,		0,01-1	mg/l
		K,		1-15	mg/l
		Ca, Mg, Na.		1-200	mg/l

Date	PT code	Parameter	Matrix	Concentration range	
13 May	VIO 20-12#	**(Heavy) metals, as dissolved:**			
		Ag*, Be*, Cd, Hg, Sb*,	gw	0,1-10	µg/l
		As, Co, Cr, Pb, Se*, Sr*, V*,		1-70	µg/l
		Al, B*, Cu, Mo, Ni, Zn,		1-300	µg/l
		Ba, Fe, K*, Mn,		0,1-20	mg/l
		Ca*, Mg*, Na*.		1-200	mg/l
4 November	VIO 20-13	NH_4,	gw **cooled transport**	0,05-2	mg N/l
		ortho-phosphate,		0,05-2	mg P/l
		pH,		4-11	pH
		Mg, K,		0,5-50	mg/l
		NO_3,		0,5-50	mg N/l
		Na, Ca, SO_4, Cl*		1-200	mg/l
		HCO_3.		1-300	mg/l
14 October	VIO 20-15	total-phosphate, ortho-phosphate,	ww **cooled transport**	0,1-5	mg P/l
		anion active detergents,		0,1-10	mg/l NalaurylSO$_4$
		F,		1-15	mg/l
		DOC,		1-15	mg C/l
		SiO_2,		1-15	mg Si/l
		NO_2,		0,2-20	mg N/l
		NH_4, NO_3,		1-50	mg N/l
		Kjeldahl-N,		0,5-60	mg N/l
		Cl, SO_4, suspended solids,		5-200	mg/l
		COD (CZV),		7-300	mg O_2/l
		total cyanide, free cyanide.		10-350	µg/l
14 October	VIO 20-16#	**(Heavy) metals, as total:**			
		Ag*, Be*, Co*, Hg, Sb*,	ww	0,5-50	µg/l
		As, B*, Ba*, Cd, Mo*, Se, Sr*, V*,		0,03-5	mg/l
		Al, Cu, Fe, Mn, Ni, Zn,		0,03-5	mg/l
		Cr, Pb,		0,03-5	mg/l
		K*,		1-15	mg/l
		Ca*, Mg*, Na*.		1-200	mg/l
24 June	VIO 20-17**	Sampling of a swimming pool in The Netherlands. In addition to field parameters free chlorine, total chlorine, pH and temperature, sampling will also carried out for urea, $KMnO_4$ and pH. These 3 parameters must be analyzed by the own laboratory.	zw	a.l.	
8 April	VIO 20-18**	bromide,	dw+sw **cooled transport**	0,05-1	mg/l
		bromate,		1-10	µg/l
		chlorate.		50-500	µg/l
17 November	VIO 20-20**	Sampling on a surface water in The Netherlands: In addition to 'field parameters' such as O_2, pH, EGV and temperature, sampling is performed for a number of chemical parameters.	sw	a.l.	

dw = drinking water, sw = surface water, gw = ground water, zw = pool water and ww = waste water

a.n. = actual level

* This parameter is not accredited by the Dutch Accreditation Council RvA (R005);

** This proficiency test is not accredited by the Dutch Accreditation Council RvA (R005).

Proficiency tests VIO 20-01 and VIO 20-12 concerning (heavy) metals to be analysed as 'dissolved'. (Heavy) metals in the proficiency tests VIO 20-09a and VIO 20-16 should be analysed as 'total'.

✓ ***For the parameters that are only stable for 24 hours the samples are delivered within 24 hours after preparation in The Netherlands and Belgium.***

5.2 Organic parameters

Date	PT code	Parameter	Casnr.	Matrix[1]	Conc. range	
29 January	VIO 20-21	**extractable organic halogens (EOX)**		sw ww***	0,02-5 10-80	µg/l µg/l
27 May	VIO 20-23	**organic chlorinated pesticides (OCP)**		dw+sw+gw ww***	0,002-1 0,1-10	µg/l µg/l
		aldrin	309-00-2			
		alpha-endosulfan	115-29-7			
		alpha-HCH	319-84-6			
		beta-HCH*	319-85-7			
		delta-HCH	319-86-8			
		dieldrin	60-57-1			
		endrin	72-20-8			
		gamma-HCH (lindane)	58-89-9			
		heptachlor	76-44-8			
		heptachlor endo epoxide isomer A	28044-83-9			
		heptachlor exo epoxide isomer B*	1024-57-3			
		hexachlorobenzene	118-74-1			
		isodrin*	465-73-6			
		o,p'-DDD	53-19-0			
		o,p'-DDE	3424-82-6			
		o,p'-DDT*	789-02-6			
		p,p'-DDT	50-29-3			
		p,p'-DDD	72-54-8			
		p,p'-DDE	72-55-9			
		pentachlorobenzene*	608-93-5			
		telodrin*	297-78-9			
		trans-chlordane*	5103-74-2			
27 May	VIO 20-24	**polychlorinated biphenyls (PCB)**		dw+sw+gw	0,002-1	µg/l
		PCB 28	7012-37-5			
		PCB 52	35693-99-3			
		PCB 101	37680-73-2			
		PCB 118	31508-00-6			
		PCB 138	35065-28-2			
		PCB 153	35065-27-1			
		PCB 180	35065-29-3			
18 March	VIO 20-25	**polycyclic aromatic hydrocarbons (PAH)**		dw+sw+gw ww	0,02-1 0,1-20	µg/l µg/l
		acenaphtene	83-32-9			
		acenaphtylene	208-96-8			
		anthracene	120-12-7			
		benzo(a)anthracene	56-55-3			
		benzo(a)pyrene	50-32-8			
		benzo(b)fluoranthene	205-99-2			
		benzo(ghi)perylene	191-24-2			
		benzo(k)fluoranthene	207-08-9			
		chrysene	218-01-9			
		dibenzo(a,h)anthracene	53-70-3			
		fluoranthene	206-44-0			
		fluorene	86-73-7			
		indeno(123-cd)pyrene	193-39-5			
		naphthalene	91-20-3			
		phenanthrene	85-01-8			
		pyrene	129-00-0			

Date	PT code	Parameter	Casnr.	Matrix[1]	Conc. range
2 September	VIO 20-26	**volatile halogenated hydrocarbons (VHH)**		dw+gw	0,1-2 µg/l
				sw	0,5-2 µg/l
		1,1,1,2-tetrachloro-ethane*	630-20-6	ww	2-200 µg/l
		1,1,1-trichloro-ethane	71-55-6		
		1,1,2,2-tetrachloro-ethane	79-34-5		
		1,1,2-trichloro-ethane	79-00-5		
		1,1-dichloro-ethane	75-34-3		
		1,1-dichloro-ethene*	75-35-4		
		1,1-dichloropropane*	78-99-9		
		1,1-dichloropropene*	563-58-6		
		1,2,3-trichloropropane	96-18-4		
		1,2-dibromo-3-chloropropane*	96-12-8		
		1,2-dibromo-ethane*	106-93-4		
		1,2-dichloro-ethane	107-06-2		
		1,2-dichloropropane	78-87-5		
		1,3-dichloropropane*	142-28-9		
		2,2-dichloropropane*	594-20-7		
		bromochloromethane	74-97-5		
		bromodichloromethane	75-27-4		
		chloroform (trichloromethane)	67-66-3		
		cis-1,2-dichloro-ethene*	156-59-2		
		cis-1,3-dichloropropene	10061-01-5		
		dibromochloromethane	124-48-1		
		dibromomethane*	74-95-3		
		dichloromethane*	75-09-2		
		hexachloro-1,3-butadiene*	87-68-3		
		hexachloro-ethane*	67-72-1		
		tetrachloro-ethene	127-18-4		
		tetrachloromethane	56-23-5		
		trans-1,2-dichloro-ethene*	156-60-5		
		trans-1,3-dichloropropene	10061-02-6		
		tribromomethane	75-25-2		
		trichloro-ethene	79-01-6		
		trichlorofluoromethane*	75-69-4		
7 October	VIO 20-27	**volatile aromatic hydrocarbons (VAH)**		dw+gw	0,1-2 µg/l
				sw	0,5-2 µg/l
		1,2,3-trichlorobenzene*	87-61-6	ww	2-200 µg/l
		1,2,3-trimethylbenzene	526-73-8		
		1,2,4-trichlorobenzene*	120-82-1		
		1,2,4-trimethylbenzene	95-63-6		
		1,2-dichlorobenzene*	95-50-1		
		1,3,5-trichlorobenzene*	108-70-3		
		1,3,5-trimethylbenzene*	108-67-8		
		1,3-dichlorobenzene*	541-73-1		
		1,4-dichlorobenzene*	106-46-7		
		2-chloromethylbenzene*	95-49-8		
		benzene	71-43-2		
		bromobenzene*	108-86-1		
		chlorobenzene	108-90-7		
		cyclohexane	110-82-7		
		dimethylbenzene, meta+para			
		dimethylbenzene, ortho	95-47-6		
		ethylbenzene	100-41-4		
		ethyl-tertiair-butylether (ETBE) *	637-92-3		
		iso-propylbenzene*	98-82-8		
		methylbenzene (toluene)	108-88-3		
		methyl-tertiair-butylether (MTBE)*	1634-04-4		
		naphthalene	91-20-3		
		n-butylbenzene*	104-51-8		
		n-propylbenzene	103-65-1		
		p-isopropyltoluene*	99-87-6		
		secundair-butylbenzene*	135-98-8		
		styrene (ethenylbenzene) *	100-42-5		
		tertiair-butylbenzene*	98-06-6		

Date	PT code	Parameter	Casnr.	Matrix[1]	Conc. range
8 April	VIO 20-28**	**Pharmaceuticals**		dw+sw+gw	0,2-2 µg/l
		diatrizoic acid	117-96-4		
		bezafibrate	41859-67-0		
		caffeine	58-08-2		
		carbamazepine	298-46-4		
		diclofenac	15307-86-5		
		phenazone	60-80-0		
		ibuprofen	15687-27-1		
		ketoprofen	22071-15-4		
		lincomycin	154-21-2		
		metoprolol	51384-51-1		
		propranolol	525-66-6		
		sotalol	3930-20-9		
		sulfamethoxazole	723-46-6		
		trimethoprim	738-70-5		
4 March	VIO 20-30	**N/P-pesticides**		dw+sw+gw	0,05-1 µg/l
		atrazine	1912-24-9		
		azinfos-methyl*	86-50-0		
		BAM*			
		chlorofenvinfos (cis + trans)			
		cyanazine	21725-46-2		
		DEET*	134-62-3		
		desethylatrazine	6190-65-4		
		desisopropylatrazine	1007-28-9		
		desmetryn	1014-69-3		
		diazinon*	333-41-5		
		dichlorvos	62-73-7		
		dimethoate	60-51-5		
		ethoprophos	13194-48-4		
		malathion*	121-75-5		
		metribuzin	21087-64-9		
		parathion-ethyl	56-38-2		
		parathion-methyl*	298-00-0		
		pirimicarb	23103-98-2		
		prometryne	7287-19-6		
		propazine	139-40-2		
		pyrazofos*	13457-18-6		
		simazine	122-34-9		
		sulfotep*	3689-24-5		
		terbutryn	886-50-0		
		terbutylazine	5915-41-3		
		tetrachlorovinphos*	961-11-5		
		tolclofos-methyl*	57018-04-9		
		chloroacetamides		dw+sw+gw	0,05-1 µg/l
		alachlor	15972-60-8		
		metazachlor	67129-08-2		
		metolachlor	51218-45-2		
		propachlor*	1918-16-7		
		bromacil	314-40-9	dw+sw+gw	0,02-1 µg/l
17 June	VIO 20-31	**chlorophenoxycarbonic acids (CPCA)**		dw+sw+gw	0,05-1 µg/l
		4,5-trichlorophenoxyacetic acid (2,4,5-T) *	93-76-5		
		2,4,5-trichlorophenoxypropionic acid (2,4,5-TP) *	93-72-1		
		2,4-dichlorophenoxyacetic acid (2,4-D)	94-75-7		
		2,4-dichlorophenoxybutanoic acid (2,4-DB)	94-82-6		
		4-chlorophenoxyacetic acid (4-CPA) *	122-88-3		
		3,6-dichloro-2-methoxybenzoic acid (dicamba)	1918-00-9		
		2-(2,4-dichlorophenoxy)-propanoic acid (dichlorprop)	120-36-5		
		(4-chloro-2-methylphenoxy)acetic acid (MCPA)	94-74-6		
		4-(4-chloro-2-methylphenoxy)butanoic acid (MCPB)	94-81-5		
		2-(2-methyl-4-chlorophenoxy)propionic acid (MCPP)	93-65-2		
		bentazone	25057-89-0	dw+sw+gw	0,02-1 µg/l

Date	PT code	Parameter	Casnr.	Matrix[1]	Conc. range
4 November	VIO 20-32	**Phenylureaherbicides (PUH)**		dw+sw+gw	0,02-1 µg/l
		chlorbromuron	13360-45-7		
		chlortoluron	15545-48-9		
		diuron	330-54-1		
		isoproturon	34123-59-6		
		linuron	330-55-2		
		methabenzthiazuron	18691-97-9		
		metobromuron	3060-89-7		
		metoxuron	19937-59-8		
		monolinuron	1746-81-2		
		monuron	150-68-5		
8 April	VIO 20-34**	**Glyphosate and AMPA**		dw+sw+gw	0,05-0,5 µg/l
		Glyphosate	1071-83-6		
		AMPA	1066-51-9		
4 November	VIO 20-38	**Mineral oil, only with the GC method**		ww	0,05-200 mg/l
23 September	VIO 19-39b**	**non target screening, semi- quantitative**		dw	0,1-1 µg/l
		semi)-quantification of various organic compounds using a LC-MS		sw	0,1-2 µg/l

[1] dw = drinking water, sw = surface water, gw = ground water and ww = waste water

* This compound is not accredited by the Dutch Accreditation Council RvA (R005);

** This proficiency test is not accredited by the Dutch Accreditation Council RvA (R005);

*** The matrix waste water is not accredited by the Dutch Accreditation Council RvA (R005).

All organic samples are cooled transported

5.3 Microbiological parameters

Date	PT code	Parameter	Matrix	Concentration range	
11 February	VIO 20-41	bacteria of the coli group *E. coli* enterococci sulphite reducing clostridia (SRCs) *Clostridium perfringens* plate count 22°C plate count 36°C	dw	0-300 0-3000	cfu/100 ml cfu/ml
9 June	VIO 20-42	bacteria of the coli group *E. coli* enterococci *Aeromonas* 30°C *Aeromonas* 37°C sulphite reducing clostridia (SRCs) *Clostridium perfringens*	dw	0-300	cfu/100 ml
13 October	VIO 20-43	bacteria of the coli group *E. coli* *Aeromonas* 30°C *Aeromonas* 37°C plate count 22°C plate count 36°C	dw	0-300 0-3000	cfu/100 ml cfu/ml
11 March	VIO 20-45	*Legionella*	dw	0-30.000	cfu/l
13 May	VIO 20-46	*Legionella*	dw	0-30.000	cfu/l
2 September	VIO 20-47	*Legionella*	dw	0-30.000	cfu/l
25 March	VIO 20-48	ATP (Adenosine triphosphate)	diluted sw+dw*	0-100	ng/l
9 September	VIO 20-50	*Salmonella* staphylococci *Pseudomonas aeruginosa*	dw	0-300	cfu/100 ml
23 June	VIO 20-53**	bacteria of the coli group thermotolerant bacteria of the coli group *E. coli* Faecal streptococci (intestinal) enterococci	sw	0-8.000	cfu/100 ml
23 September	VIO 20-54**	bacteria of the coli group thermotolerant bacteria of the coli group *E. coli* Faecal streptococci (intestinal) enterococci	sw	0-8.000	cfu/100 ml
11 March	VIO 20-55**	*Legionella*	kw	0-50.000	cfu/l
2 September	VIO 20-56**	*Legionella*	kw	0-50.000	cfu/l
11 March	VIO 20-59**	*Legionella pneumophila* qPCR	dw	0-1×10^6	DNA-copies/l
11 March	VIO 20-61**	*Legionella pneumophila* qPCR	kw	0-1×10^6	DNA-copies/l
25 March	VIO 20-62**	F-specific RNA-phages and somatic coli-phages	dw	0-150	pve/ml
25 March	VIO 20-63**	Total bacterial cell counting (incl. fraction dead and alive), flowcytometric	dw	1×10^3-1×10^6	cells/ml

cfu = colony forming unit, dw = drinking water, sw = surface water, kw = cooling-water

* In this PT, ATP is also offered in drinking water and this matrix is not accredited by Dutch Accreditation Council (R005).
** This proficiency test is not accredited by the Dutch Accreditation Council RvA (R005).

Cooled transportation is provided for all microbiological samples. All samples are delivered within 24 hours after preparation in The Netherlands and Belgium.

Subscription form KWR Proficiency Tests 2020

You can indicate which proficiency tests you want subscription. You will receive a confirmation of participation.

PT	Description	Matrix	Price
☐ VIO 20-01	(Heavy) metals, as dissolved	dw	€ 1.220
☐ VIO 20-02	General- and macro parameters	dw	€ 1.720
☐ VIO 20-06	Urea, cyanuric acid, $KMnO_4$, free chlorine and total chlorine	zw	€ 915
☐ VIO 20-07	Nutrients	sw	€ 1.650
☐ VIO 20-09a	(Heavy) metals, as total	sw	€ 1.220
☐ VIO 20-12	(Heavy) metals, as dissolved	gw	€ 1.160
☐ VIO 20-13	General- and macro parameters	gw	€ 1.275
☐ VIO 20-15	General- and macro parameters	ww	€ 1.275
☐ VIO 20-16	(Heavy) metals, as total	ww	€ 975
☐ VIO 20-17	Sampling of a swimming pool in The Netherlands	zw	€ 555
☐ VIO 20-18	Bromide, bromate and chlorate	dw+sw	€ 510
☐ VIO 20-20	Sampling of a surface water in The Netherlands	sw	€ 650
	Total contribution inorganic proficiency tests		€

dw = drinking water, sw = surface water, gw = ground water, ww = waste water and zw = pool water

PT	Description	Matrix	Price
☐ VIO 20-21	Extractable organic halogens (EOX)	sw ww	€ 895
☐ VIO 20-23	Organic chlorinated pesticides (OCP)	dw sw gw ww	€ 1.205
☐ VIO 20-24	Polychlorinated biphenyls (PCB)	dw sw gw	€ 940
☐ VIO 20-25	Polycyclic aromatic hydrocarbons (PAH)	dw sw gw ww	€ 1.070
☐ VIO 20-26	Volatile halogenated hydrocarbons (VHH)	dw sw gw ww	€ 1.220
☐ VIO 20-27	Volatile aromatic hydrocarbons (VAH)	dw sw gw ww	€ 1.220
☐ VIO 20-28	Pharmaceuticals	dw sw gw	€ 1.220
☐ VIO 20-30	N/P-pesticides	dw sw gw	€ 1.205
☐ VIO 20-31	Chlorophenoxycarbonic acids (CPCA)/bentazone	dw sw gw	€ 1.220
☐ VIO 20-32	Phenylureaherbicides (PUH)	dw sw gw	€ 935
☐ VIO 20-34	Glyphosate and AMPA	dw sw gw	€ 1.035
☐ VIO 20-38	Mineral oil, only with GC method	ww	€ 265
☐ VIO 20-39b	Non-target screening, semi-quantitative LC-MS	dw sw	€ 1.035
	Total contribution organic proficiency tests		€

dw = drinking water, sw = surface water, gw = ground water and ww = waste water

PT	Description	Matrix	Price
☐ VIO 20-41	Bacteriological parameters	dw	€ 900
☐ VIO 20-42#	Bacteriological parameters	dw	€ 900
☐ VIO 20-43	Bacteriological parameters	dw	€ 900
☐ VIO 20-45	*Legionella*	dw	€ 595
☐ VIO 20-46#	*Legionella*	dw	€ 595
☐ VIO 20-47	*Legionella*	dw	€ 595
☐ VIO 20-48	ATP	diluted sw + dw	€ 935
☐ VIO 20-50	*Salmonella*, staphylococci and *Pseudomonas aeruginosa*	dw	€ 900
☐ VIO 20-53	Bacteriological parameters	sw	€ 900
☐ VIO 20-54#	Bacteriological parameters	sw	€ 900
☐ VIO 20-55	*Legionella*	kw	€ 595
☐ VIO 20-56#	*Legionella*	kw	€ 595
☐ VIO 20-59	*Legionella pneumophila* qPCR	dw	€ 540
☐ VIO 20-61	*Legionella pneumophila* qPCR	kw	€ 540
☐ VIO 20-62	F-specific RNA-phages and somatic coli-phages	dw	€ 675
☐ VIO 20-63	Total bacterial cell counting (incl. fraction dead and alive), flowcytometric	dw	€ 675

This proficiency test is optional. Only if there are enough participants this test will go on.

Total contribution microbiological proficiency tests €

dw = drinking water, sw = surface water and kw = cooling water

		Total contribution proficiency tests	€
Discount	**participation in 5-9 proficiency tests**	**- 5%**	- €
	participation in 10-19 proficiency tests	**- 10%**	- €
	participation in > 20 proficiency tests	**- 15%**	- €
		Total contribution in euros	€

- ✓ *When less than eight participants subscribe, KWR reserves the right to cancel the proficiency test. You will then be informed by email in time.*
- ✓ *The total costs will be invoiced in two equal amounts, unless other agreements are made with you. If changes in your order occur during the year, an adapted cost accounting will be handled in the second period.*
- ✓ *The prices in the program are excluding carriage costs. Transport costs, based on actual transportation costs by post-calculation, will be charged.*
- ✓ *If you wish to cancel a proficiency test, you need at least four weeks before the date of receipt of the proficiency test notify us in writing. After this period the costs of the test will be charged.*
- ✓ *The General Terms and Conditions for the Supply of Goods and Provision of Services and Purchase placed with KWR are applied on this tender. You can find these terms and conditions on KWR website www.kwrwater.nl/voorwaarden/.*

	Your data	
Comany		**Date of entry**
Correspondention attn.		
Telephone		
PO-box		**Client**
Zip code/Place/Country		
E-mail		
Samples attn.		
Telephone		**Autograph**
Address		
Zip code/Place/Country		
E-mail		

6 Lay-out of the final report

6.1 Samples and standardsolutions

The chemical proficiency tests of KWR use the so-called Youden. This implies that per parameter at least two samples are distributed for analysis. These two samples are practically identical for the parameter to be analysed. There is only a slight difference in concentration between the two samples, by adding known amounts of the parameter (by 'spiking'). This lay-out enables participants to obtain a good indication if deviating results are caused by systematic errors and/or by relatively large random errors. The within laboratory reproducibility and/or repeatability of the individual participants are not tested. Because of the difference in concentration between the samples of a Youden pair is known (theoretical value), the accuracy can also be assessed. Unfortunately, for a number of parameters this is not possible since they are part of an equilibrium (e.g. carbonate and hydrogen carbonate), or because some parameters are not stable over a longer period of time (e.g. nitrite; because of bacterial activity the concentration of nitrite will decrease in time). In these situations an indication of the theoretical value will be given if possible.
In a number of chemical proficiency tests also one or two standard solutions (the parameter to be analysed is added to a solvent matrix or ultra-pure water) are offered. It is known that for many analytical methods matrix problems and/or problems with preparation and pre-concentration of the sample play a role. To examine this and to simplify the interpretation of the analytical results, one or two standard solutions are offered for analysis. The results for the standard solutions are not involved in the final assessment (report mark and Z-scores).
In the microbiological proficiency tests, the Youden lay-out is not applied. In these tests four samples are usually being distributed. Every sample is assesses separately and furthermore one combined assessment is given for all four samples (Good, Moderate, Bad).

6.1.1 Criteria minimum number of laboratory results

The minimum number of laboratory results (observations for a parameter/sample set combination) that must be present in order to perform statistical analysis on has been set at eleven results. If the number of laboratory results is less than eleven, then the usual statistical key figures (mean, standard deviation, etc.) and the alternative Z-scores were calculated. Only the judgment (Good, Moderate, Bad) based on the Z-scores than omitted. And if there are less than four laboratory results, the Youden plots (only for chemical tests) are not made.

6.1.2 Consensus value as assigned value

The arithmetic mean of the results of the participants after removal of outliers – the consensus value – is used as assigned value for the calculation of the Z-score compared to the group average, so based on this Z-score the participant can be assessed compared to the group average.

6.1.3 Difference from additions as assigned value

For some chemical proficiency testing the difference addition from Youden sample-pairs – referred to as the theoretical value – is also used as assigned value. Since its information can be obtained on the addition-recovery and a systematic error of the measurement (both important for the report mark). Furthermore, for each participant the Z-score compared to the theoretical value (Z_t) is calculated.

6.2 Graphical presentation of the results

In the final report a graphical presentation is given by means of a saw tooth plot and, if applicable, a Youden plot (see also figures 1 and 2). Furthermore, a graphical presentation of the Z-score is given (see figure 6).

6.2.1 Sawtooth plot

The sawtooth plot is a graphical representation of the results of all participants for a standard solution and for the samples. On the x-axis the random numbers are shown and on the y-axis the measured values. Using the saw tooth plot, the individual result of each of the laboratories can be compared with the results of the other participating laboratories. In the plots, the results of the participating laboratories are displayed without any outliers.

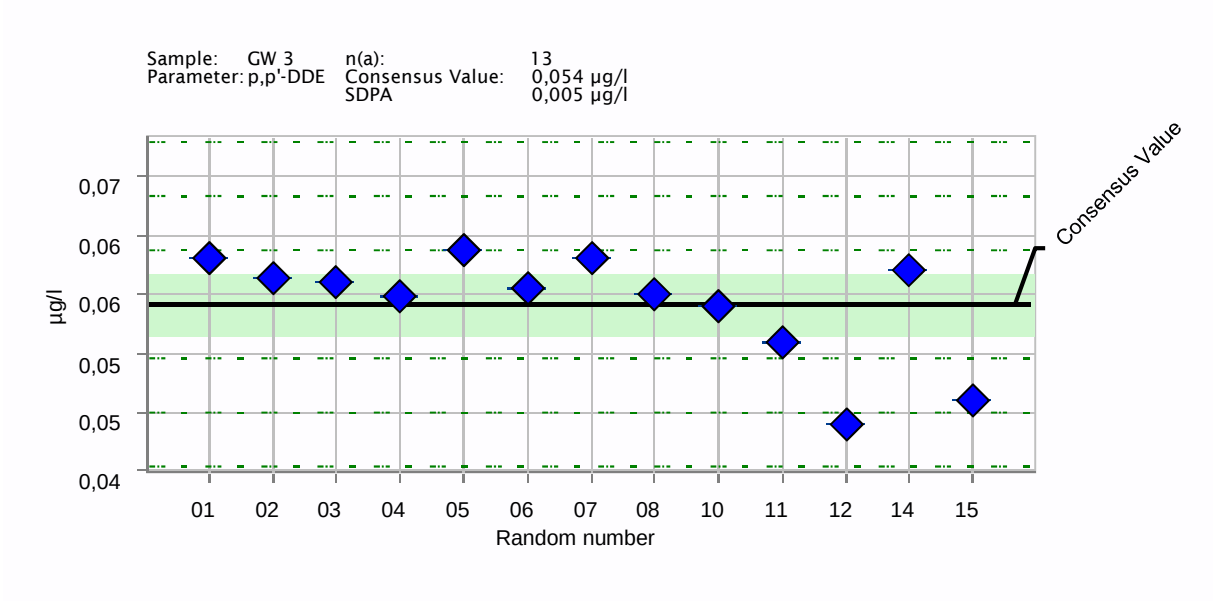

Figure 1: Sample of a sawtooth plot

The dotted lines in the graph show 1 × SDPA, 2 × SDPA and 3 × SDPA respectively. The light green marked part concerns the 95% confidence interval.

6.2.2 Youden plot

The Youden plot is a graphical representation of the results for the two samples of a Youden pair. For each laboratory, the result of the first sample (on the x-axis) is plotted against the result of the second sample (on the y-axis). The lines perpendicular to the x-axis and the y-axis are the averages of the two samples. The radius of the circles are determined by the standard deviation caused by random errors. If there are no systematic errors, with a normal distribution about 95% of the results will lie within the smallest circle and about 99% of the results will lie within the largest circle. Furthermore, the results will also be equally distributed over the four quadrants.
Also, a 45°-line through the 1st and 3rd quadrant is also displayed in the plot. From the Youden plot it can be established whether the mistake made is accidental or systematic.

To apply the special statistics, as developed by Youden, the following conditions must be met:

- the minimum number of participants is 4 (after also applying the test on outliers);
- the random error is of the same level for all laboratories;
- the systematic error for both samples is of the same order of magnitude within one laboratory;
- to enable a sound interpretation of the circles in the Youden plot, the results should come from a normal distribution.

The following interpretation can be made from the Youden plot:
The further away a laboratory is from the center of the plot along the diagonal line, the greater a systematic error of that laboratory. Laboratories that lie within the radius show neither systematic error nor poor repeatability at the indicated significance level (5%, 1% or 0.1%).

Systematic errors will cause observations to occur in the first and third quadrant of the Youden plot. When there are no random errors all points will lie on the 45°-line that passes through the 1st and 3rd quadrant (the 1st quadrant is situated top right, the other ones run up clockwise). With random errors, inevitable in practice, in combination with detectable systematic errors the points will lie in a drawn-out ellipse round the 45°-line. The length of the perpendicular from the plotted point of the laboratory to the 45°-line will be a measure for the random error of that laboratory. The distance along the 45°-line, from the centre of the circle to the point of intersection with the perpendicular is a measure for the systematic error of the laboratory. The Youden plot concerns only one combined observation in time, therefore no more than a global indication of the type of errors (random or systematic) can be obtained. When a laboratory has participated in more inter-laboratory test comparisons with the same parameters, the results can indeed confirm a pattern in the type of errors.

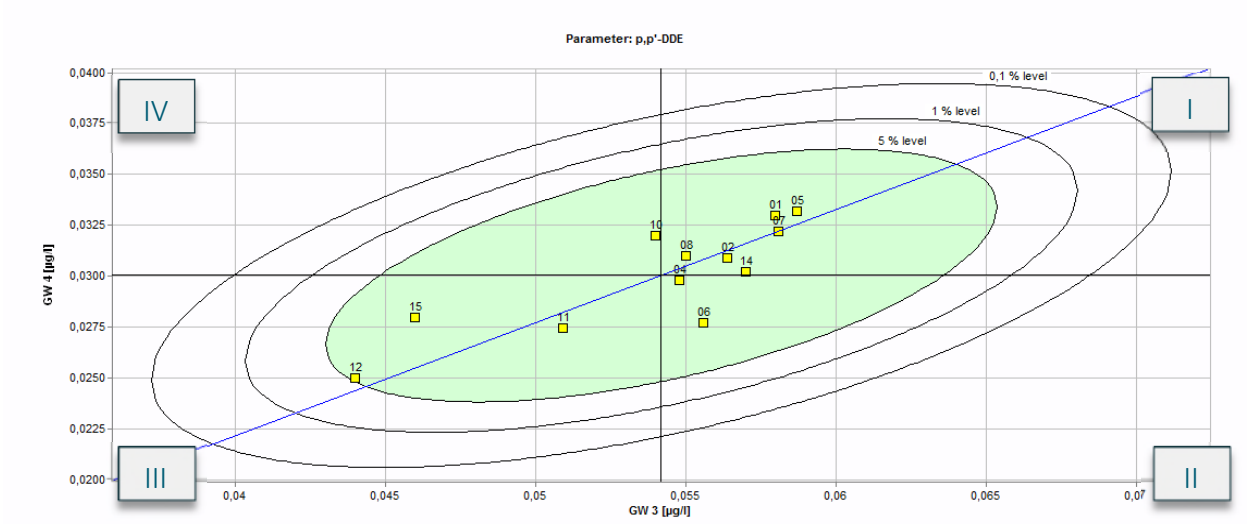

Figure 2: Sample of a Youdenplot

Some examples of how to interpret a Youden plot are given below.

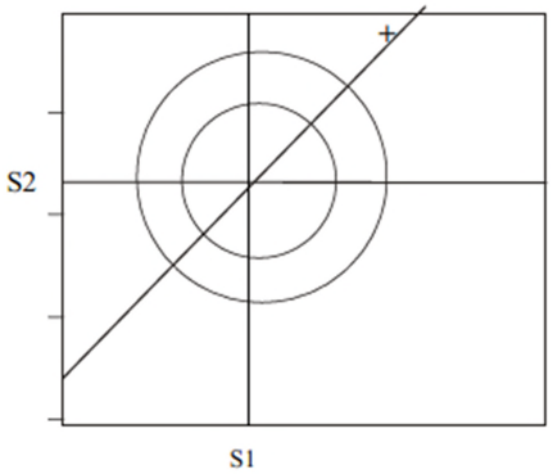

Figure 3: Example of a large systematic error, above the average of the group

In this example the results of a participant are shown with a '+'. The samples (S1 and S2) are samples from one Youden pair. There is only a slight difference in concentration between the two samples. On the x-axis the result of sample 1 is plotted and on the y-axis the result of sample 2. In this graph you can clearly see that the reported concentrations for both sample 1 and sample 2 are too high. This indicates the presence of a large systematic error. It is possible that this participant has a problem with its blank procedure.

The same as in figure 3, but now the participant is analyzing systematically too low. A low recovery could be the problem. The length of the perpendicular (dotted line) to the 45°-line is representative for the size of the random error. The distance along the 45°-line, from the centre of the circle to the point of intersection with the perpendicular represents the size of the systematic error. Most errors will be a combination of random and systematic errors.

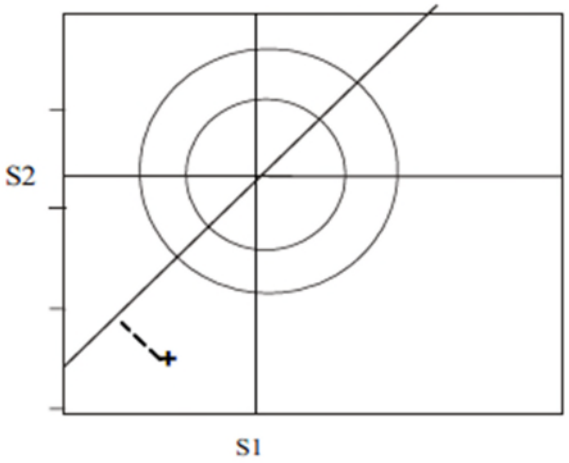

Figure 4: Example of a large systematic error, below the average of the group

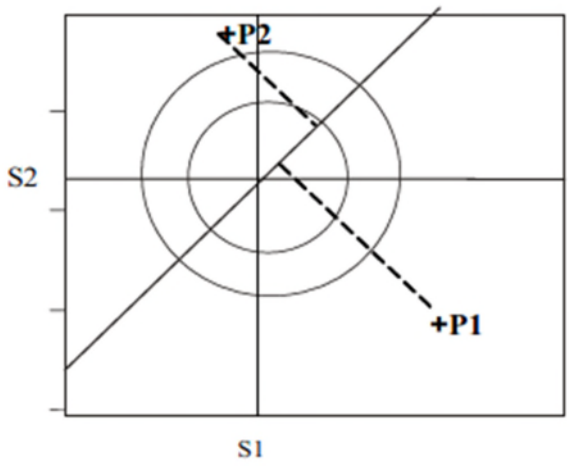

Figure 5. Example of random errors

In this plot two examples of random errors are given. Participant 1 (P1) finds for sample 1 a higher value and for sample 2 a lower value than the average value of the group. Both samples are not correctly analysed and/or reported. This may indicate a sample exchange. Participant 2 (P2) scores very close to the average group value for sample 1, but for sample 2 far above the average group value and for both samples (Youden) outside the 2s border. It is not possible to draw a conclusion on systematic basis and therefore these errors may be considered as random. You could think of a once-only error, e.g. adding no reagent samples during the analysis.

When a participant has a deviating score or is even an outlier, it is of utmost importance to find the cause(s). KWR herewith would like to point out that it is absolutely useful first to check for trivial causes, such as sample exchange, typing errors, dilution errors etc. Research performed by KWR in 1996 showed that 30% of all proficiency testing relating errors were trivial. This first check is very easy to perform with a fairly large chance of getting results. When no causes are found after this first and quick check, it is useful to check the analytical method applied.

6.3 Report mark

The report mark gives an idea of the performance of a group on a scale of 0 to 10, and is an instrument to assess group performances over a longer period of time. It can be used to identify for which parameters the analytical method has to be reconsidered or to see certain trends in results as a consequence of (inter)national harmonisation of analytical methods. The report mark is only calculated in the chemical proficiency tests.

The mark is calculated by weighing the scores for the following items:

- percentage of outliers (the outliers in the group of differences of the two results of a Youden pair);
- recovery of the spike, where applicable;
- occurrence of systematic errors (only with normal distribution of the results);
- coefficient of variation of the reproducibility.. Het rapportcijfer wordt alleen bij de chemische ringonderzoeken toegepast.

The report marks are calculated per real sample matrix and per parameter. However, in some cases no 'theoretical value' is known. Consequently, it is not possible to calculate a recovery of the spike or a systematic error with regard to the theoretical value (known as "systematic error with marginal note"). In these cases an alternative report mark will be calculated that does not take into account these two items. This alternative report mark is always calculated. The table with the basic statistics for the calculation of the report mark also presents a standard deviation of the repeatability (sr); this can be seen as an average for the participating group. The special Youden lay-out enables the calculation of this statistical number, even though there are no repeated measurements. An underlying assumption however, is that in each laboratory both samples were analysed in the same series of measurements.

Example of a report mark calculation of a Youden pair with known theoretical value:

VIO xx-xx, parameter y Samples S1, S2	Youden pair δ = 0,0800 mg/l	Score	
Participating laboratories	15		
Outliers	(0) 0 %	10	
Remaining laboratories	15		
Normal distribution	Yes	Yes	
Average difference	-0,0554 ug/l		
Median difference	-0,0560 ug/l		
Recovery of spike	79,1 %	6	
Syst. Error of the measurement	1%>=P	0	0
Syst. Error between laboratories	1%>=P	0	
Group average result	0,1177 ug/l		
Stand.dev. repeatability	0,0129 ug/l		
Stand.dev. reproducibility	0,0283 ug/l		
Coëff. of var. reproducibility	24,0%	6	
Report mark	**5,5**	**7,3** **alternative ***	

6.4 Z-score

To enable a participant in a proficiency test to assess his or her results in an equivocal way, Z-scores are presented. Z-scores are an internationally accepted way to assess the performance of an individual laboratory. It also enables participants to follow the own performance in time. The Z-score presents the deviation from the group average or the theoretical value and is related to the standard deviation of the group.

For the assessment of the performance of ones own laboratory, a distinction is made between the assessment of the following performances:

- of ones own laboratory with regard to the group average;
- of ones own laboratory with regard to the theoretical value (the real difference in spikes of the two samples) and
- of ones own laboratory in time (not given in the final report)

For the calculation of the Z-scores with regard to the group average, the standard deviation of the reproducibility (s_R) of the individual samples is used.

For the calculation of the Z-scores with regard to the theoretical value, KWR has chosen to use the standard deviation of the repeatability (s_r), which is calculated from the Youden pair.

If there are less than 11 results, after removal of outliers, KWR chooses to make the calculation of the average and the standard deviation to calculate alternative Z-scores (Z_{alt}-score) wherein the uncertainty of the value assigned to (consensus value) is included. This is an approach which is also specified in ISO 13528.

The various Z-scores are also presented graphically. An example is shown in figure 6.

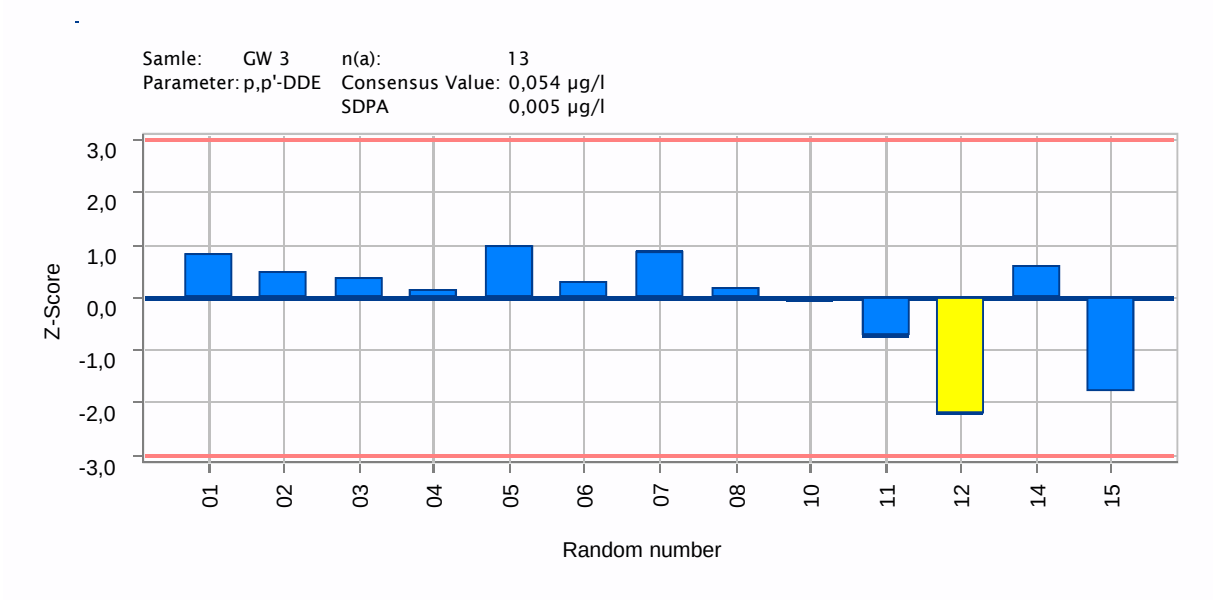

Figure 6: Example of the graphically presentation of the Z-scores