Memorandum

To: Ms. Linda Kiefer, USEPA PM, Lowry Landfill Superfund Site

From: Tim Shangraw (EMSI) and Lyn Brill (Parsons)

Cc: Steve Richtel (WM), Dave Wilmoth (Denver), Laurie Wright (PWT), Bruce Peterman (PWT)

Date: 03 December 2020

Re: **1,4-Dioxane PQL Update, Lowry Landfill Superfund Site**

On behalf of the City and County of Denver, Waste Management of Colorado, Inc., and Chemical Waste Management, Inc., hereafter referred to as the Work Settling Defendants (WSDs) this Technical Memorandum (TM) serves as the Practical Quantitation Limit (PQL) Update for 1,4-dioxane in groundwater beneath and adjacent to the Lowry Landfill Superfund Site (the Site). This PQL Update is being submitted in accordance with Subsection 2.4.2 of the Statement of Work (SOW) attached as Exhibit C to the Consent Decree (CD) entered by the US District Court for the District of Colorado on 28 September 2005 (and reentered on 16 November 2005) in Civil Action No. 02-CV-01341-EWN-MJW, that requires annual updates be submitted "for compounds of concern that are monitored at the Site for which the PQL exceeds a numeric performance standard".

EPA's technical oversight contractor, Pacific Western Technologies, LLC (PWT) provided a technical review of this TM for accuracy and completeness. Where appropriate, PWT also provided independent research into available analytical methods, and outreach to analytical laboratories to assess the level of commercially-available services for low-level quantification of 1,4-dioxane. Results from that outreach are incorporated into this TM.

BACKGROUND

A 2014 PQL Study (WSDs, LLSS, 2014) using Appendix A "Development of a Discharge/Site Specific PQL" from CDPHE PQL Guidance Document (2012) and follow-on 2015 Method Comparison Study (WSDs, LLSS, 2015) was conducted on groundwater from the Site that concluded analytical methods using isotope dilution with 1,4-dioxane-d8 as the internal standard (referred to as simply "isotope dilution") are more accurate than those that do not apply isotope dilution (ID) because the 1,4-dioxane-d8 better reflects ionization response, extraction recovery, and retention time of the target analyte. The Lowry 2014 PQL study and follow-on Method Comparison Study also concluded that for Lowry groundwater, the ChemSolutions LLC (ChemSolutions) USEPA Method 8260SIM ID was the most accurate and produced a lower Method Detection Limit (MDL) and more reasonable PQL than any other method tested. Their MDL was 0.15 µg/L and PQL was 0.9 µg/L.

Based on this experience, and because ChemSolutions' analytical chemists retired last year, the WSDs conducted another PQL Study in 2019 using three laboratories who offered 1,4-dioxane analyses using method USEPA Method 8260SIM ID. The three laboratories were the only labs identified in a nationwide search that routinely run this method. The Pace Analytical laboratory in Madison, WI was selected because they produced the most accurate results at the lowest concentration. Their MDL was 0.09 µg/L and PQL was 0.9 µg/L. That PQL Study is appended to this TM for reference.

RECENT RESEARCH

In an effort to assess state-of-the-art analytical methods that are currently commercially available to quantify low-level concentrations of 1,4-dioxane in groundwater, the WSDs 1) reached out to the three analytical laboratories that participated in the 2019 PQL Study to assess whether they have upgraded, altered, or in any way changed their analytical methods for 1,4-dioxane analyses; and 2) researched available literature for new information on analytical methods that might be more accurate than the 8260SIM ID method. One of the three laboratories that participated in the 2019 PQL study, Summit Environmental of Cuyahoga Falls, OH, reported they no longer offer 8260SIM ID analyses. The other two, as indicated below, responded that no changes have been made to their analytical methods.

	Pace Analytical (Madison, WI)	**Eurofins (Arvada, CO)**
Method	8260SIM ID	8260SIM ID
Contact Information	Nick Nigro 2525 Advance Road, Madison, WI 53178 608-221-8700	Betsy Sara 4955 Yarrow Street Arvada, CO 80002 (303) 736-0189
Comment	No Changes	No Changes

The WSDs recently contacted additional commercial laboratories who analyze groundwater for low-level 1,4-dioxane. Inquiries also assessed whether the laboratories have upgraded, altered, or in any way changed their 1,4-dioxane analytical methods in the past two years. Findings are summarized below:

	ALS Life Sciences Division	Colorado Analytical	SGS	Eurofins	Alpha Analytical
Method	8270C	522	8260SIM ID 8270SIM ID	522 8270SIM ID	8270 SIM ID
Contact Information	Lisa Domenighini 1317 S 13th Ave Kelso, WA 98626	Joel Fay 10411 Heinz Way, Commerce City, CO 80640	sgs-ehusa.com	Betsy Sara 4955 Yarrow Street Arvada, CO 80002 (303) 736-0189	Nicole Hunt 8 Walkup Drive Westborough, MA 01581 508-439-5137
Comment	No changes	PQL of 1 µg/L	Lab added these two methods since last year, bµt offered no modifications to methods to improve performance	Same 522 method as last year, but lab added 8270SIM ID. No modifications to either method to improve performance	No Changes

Two years ago, PWT investigated reported detection limits for 17 published analytical methods. As summarized in Table 1, only one of the methods had an MDL or reporting limit (similar to PQLs) less than 0.09 µg/L or 0.9 µg/L, respectively. It was Drinking Water Method 522. While the MDL reported is lower than that reported by Pace Analytical, the matrix of water tested differs from that of Lowry groundwater, so the MDLs cannot be compared. The applicability of Drinking Water Method 522 to Lowry groundwater is discussed below.

Additional review by the WSDs and PWT of other published literature and available laboratory techniques indicates that, although there are some new method innovations such as frozen micro-extraction and salted purge procedures followed by GC/MS SIM, reporting limits for these procedures are no better than those achieved by the current Pace Analytical 8260SIM ID method.

USEPA DRINKING WATER METHOD 522

Additional research into the use of USEPA Drinking Water Method 522 was conducted because, as reported in Table 1, the published detection limits for this method are lower than the MDL and PQL derived from the Pace Analytical 8280SIM ID method for Lowry groundwater. The USEPA Unregulated Contaminant Monitoring Rule (UCMR) has adopted a Method 522 reporting limit of 0.07 µg/L for 1,4-dioxane in finished drinking water. The method employs solid phase extraction followed by GC/MS with SIM using a 1,4-dioxane-d8 surrogate, but not a 1,4-dioxane-d8 internal standard. The following technical issues complicate the comparison of Method 522 detection limits to those of Pace Analytical's method on Lowry groundwater:

Reporting Limit Determination: Method detection limits are matrix, instrument and analyst specific and require a well-defined analytical method. The Method 522 reporting limit is derived from a different statistical process using the lowest concentration minimum reporting level (LCMRL) using spiked reagent water (EPA 2012), not Lowry groundwater.

Matrix Differences: Sampling for the UCMR program occurs at the entry point to the distribution system (treated water), where the water is expected to meet Primary Drinking Water Standards. In contrast, the Lowry groundwater contains nutrients, metals, anions, and

organic compounds at levels higher than typical treated drinking water. In Table 5 of Method 522, accuracy and precision information is provided for surface water and groundwater spiked at 1 µg/L. Both matrices exhibit interferences between 1 and 10 times (0.07-0.66 µg/L) the minimum reporting limit.

1,4-dioxane-d8 surrogate vs internal standard: Method 522 uses 1,4-dioxane-d8 as a surrogate spike. A surrogate spike is used to measure the losses from extraction and analysis. The recovery is calculated but not used to correct sample concentration. When 1,4-dioxane-d8 is used as an internal standard it mimics the behavior of the analyte in question while providing a signal on the instrument that can be distinguished from that of the analyte. Ideally, any factor that affects the analyte signal should affect the signal of the internal standard to the same degree. When using an internal standard other than 1,4-dioxane-d8, the results are biased low because 1,4-dioxane has a poor extraction/purge efficiency. This was apparent in the initial results of split sampling of Lowry groundwater with the USEPA (ESAT split sampling effort 2017-2018). The internal standards used for the USEPA method were not similar in ionization response, extraction recovery, or retention time to 1,4-dioxane. This resulted in low recoveries for the USEPA samples. Therefore, using an internal standard other than 1,4-dioxane-d8 (or other deuterated form) will likely result in poor accuracy and low bias.

Quality Indicators: The Method 522 reporting limit is based on an acceptable accuracy of 50-150%, which may not be reasonable for the Lowry monitoring effort or for analytes with low regulatory drivers. A reasonable accuracy for Lowry analytical methods was established at 75-125% (see WSDs 2014 and 2015). This tighter range of accuracy results in a much more accurate quantitation of analytical results, which in turn, provides a more realistic picture of actual site conditions for groundwater plume delineation.

SUMMARY OF USEPA Method 522 Research

For USEPA Method 522 a *"Lowest Concentration Minimum Reporting Level"* is calculated following technical guidance and a USEPA calculator. The statistical method was developed in 2006 and used to determine the method detection limits for 1,4-dioxane during the Unregulated Contaminant Monitoring Rule 3 work. This is not comparable to the 40 CFR Part 136 Appendix B USEPA MDL procedure and cannot be compared to detection limits developed using the USEPA MDL process.

Additionally,

- The LCMRL is determined in reagent water, not the sample matrix.
- The manual LCMRL process requires a strong understanding of statistics, excel formulas and arrays, and possibly a commercial statistical software package.
- USEPA Document # 815-R-05-006 - The LCMRL cannot be less than the lowest spiked concentration or lowest calibration standard for a particular analyte. Unless the laboratory runs a calibration a standard at the LCMRL, the LCMRL and associated results should not be considered valid.
- If a Site-Specific LCMRL is considered (and as yet there is no such precedent set at the National or State level), the LCMRL calculator recommends seven spiking levels with four replicates per level for the collection of a total of 28 samples per laboratory and subsequent analyses, which is more than the current USEPA MDL process and the CDPHE policy require.

- The LCMRL calculator is developed on a 16-bit computer application platform and cannot directly be used on a 32- or 64-bit computer system. Calculations would have to be performed manually if the LCMRL calculator is not updated for compatibility to current operating systems. USEPA only has a 64-bit test version.

REGULATORY STATUS OF 1,4-DIOXANE

The National Contingency Plan defines acceptable exposure levels for known or suspected carcinogens as those that "…are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response." (40 CFR 300.430(e)(2)(i)(A)(2). Accordingly, USEPA has established drinking water Health Advisories (HAs) for 1,4-dioxane (aka p-dioxane), which are drinking water-specific risk level concentrations for cancer risk of 10^{-4}. The USEPA established a 1-day HA of 4,000 µg/L and a 10-day HA of 400 µg/L for 1,4-dioxane in drinking water for a 10-kilogram child. USEPA also established a lifetime HA of 200 µg/L for 1,4-dioxane (p-dioxane) in drinking water (EPA 2012). The USEPA's drinking water equivalent level for 1,4-dioxane is 1,000 µg/L (EPA 2012). USEPA has calculated a screening level of 0.46 µg/L for 1,4-dioxane in tap water, based on a 1 in 10^{-6} lifetime excess cancer risk (EPA 2017).

CONCLUSION AND RECOMMENDATION

Based on the research offered in this TM, the current 8260SIM ID analytical method applied by Pace Analytical appears to be state-of-the-art for analysis of low-level 1,4-dioxane in Lowry groundwater that contains elevated levels of suspended and dissolved solids. Two of the analytical laboratories who participated in the 2019 PQL study testing Lowry groundwater have not changed their analytical methods, and the third laboratory no longer offers 8260SIM ID method analysis for 1,4-dioxane. Thus, there is little reason to believe that the outcome of another round of MDL studies would differ from that observed in 2019. To the issue of other commercially-available analytical methods that are capable of analyzing Lowry groundwater to lower detection limits with a reasonable degree of confidence, WSDs and PWT were both unable to identify one.

The current MDL and PQL offered by Pace Analytical are 0.09 µg/L and 0.9 µg/L, respectively. The adequacy of these levels relative to USEPA health advisories, USEPA drinking water limits, and USEPA screening levels for tap water are as follows:

- 1-Day Health Advisory for children = 4,000 µg/L;
- 10-Day Health Advisory for children = 400 µg/L;
- Lifetime Health Advisory = 200 µg/L. USEPA's drinking water equivalent is 1,000 µg/L;
- EPA's screening level for 1,4-dioxane in tap water at $1x10^{-6}$ lifetime excess cancer risk = 0.46 µg/L.
- The State of Colorado provides a value of 0.35 µg/L per Regulation No. 41 - The Basic Standards for Ground Water, 5 CCR 1002-41.

Considering all the technical, commercial availability, and regulatory issues raised in this TM, WSDs recommend moving forward with the current 8260SIM ID method offered by Pace Analytical with an MDL of 0.09 µg/L and PQL of 0.90 µg/L.

REFERENCES

USEPA, 2012. "2012 Edition of Drinking Water Standards and Health Advisories." water.epa.gov/action/advisories/drinking/upload/d wstandards2012.pdf

USEPA, 2013c. Regional Screening Level (RSL) Summary Table.

USEPA, 2014. SW-846 Method 3535A Solid-Phase Extraction (SPE). ASTM, D 1193 – 99, Standard Specifications for Reagent Water

USEPA, 2017. Technical Fact Sheet – 1,4-Dioxane, November 2017

Work Settling Defendants (WSDs), LLSS (2014). Results of Lowry-Specific PQL for 1,4-Dioxane in Groundwater at the Lowry Landfill Superfund Site, Memo to L Sims from T. Shangraw and L Brill. February 20, 2014

WSDs, LLSS (2015). Results of Method Comparison Study for Low-Level 1,4-Dioxane in Groundwater at the Lowry Landfill Superfund Site, Memo to L. Sims from T. Shangraw and L. Brill. May 1, 2015

Table 1 - List of Published Methods

MATRIX	METHOD	INSTRUMENTATION	DETECTION LIMIT	COMMENTS
Soil, Water	EPA SW 846 Method 8015	GC/FID	15 µg/L (MDL)	
Soil, Water	EPA SW 846 Method 8240	GC/MS Purge and trap or direct injection	???	
Soil, Water	EPA SW 846 Method 8260	GC/MS	????	
Soil, Water	EPA SW 846 Method 8260 SIM	GC/MS-SIM	0.5 - 10.0 µg/L (MDL)	
Soil, Water, Tissue	EPA SW 846 Method 8261	VD/GC/MS	1.1 µg/L (MDL)	
Soil, Water	EPA SW 846 Method 8270	GC/MS	0.23 - 1.0 µg/L (MDL)	
Soil, Water	EPA SW 846 Method 8270 SIM	GC/MS-SIM		
Water	EPA Method 522	SPE, GC/MS-SIM	0.020 -0.036 µg/L (DL) 0.036-0.047 µg/L (LCMRL)	UCMR program uses LCMRL of 0.07 µg/L
Water	EPA CLP Method OLMO3.1 (1994)	GC/MS SIM	5 µg/L (CRQL)	
Surface Water	Determination of 1,4-Dioxane in the Cape Fear River Watershed by Heated Purge-and-Trap Preconcentration and Gas Chromatography–Mass Spectrometry	GC/MS SIM Isotopic Dilution	0.15 µg/L (RL)	Mei Sun, Catalina Lopez-Velandia, and Detlef R. U. Knappe *Environ. Sci. Technol.*, 2016, *50* (5), pp 2246–2016
Water	SM Method 1624, Revision B:	Isotope Dilution GC/MS	10 µg/L (ML)	
Water	Non-purgeable volatile organic compounds rapidly determined by gas chromatography/mass spectrometry using direct aqueous injection	Direct Aqueous Injection GC/MS	88 ppb (average MDL)	Pyle, S.M. ; Marcus, A.B. ; Johnson, L.S.EPA--600/A-95/056

MATRIX	METHOD	INSTRUMENTATION	DETECTION LIMIT	COMMENTS
Groundwater	Rapid Analysis of 1,4-Dioxane in Groundwater by Frozen Micro-Extraction with Gas Chromatography/Mass Spectrometry	Frozen micro extraction GC/MS-SIM	1.6 µg/L (LOD)	Mengyan Li, Patrick Conlon, Stephanie Fiorenza, Rock J. Vitale, and Pedro J.J. Alvarez, Ground Water Monitoring & Remediation,2001
Water	3EIASOP-VOZDIOX3 Standard Operating Procedure for Measurement of Purgeable 1,4-Dioxane in Water by GC/MS	GC MS Purge and trap		
liquid, solid, and oily waste matrices, as well as animal tissues	EPA METHOD 8261A	This method is based on a vacuum distillation and cryogenic trapping procedure (Method 5032) followed by gas chromatography/mass spectrometry (GC/MS). The method incorporates internal standard-based matrix correction	5 µg/L (LLOD)	
Water, Groundwater, Leachate	EPA 8015C	GC	12 µg/L (MDL)	
Water	USGS O-4127-96	GC/MS	11.5 µg/L	

Appendix A

Results of the 1,4-Dioxane PQL Study in Groundwater
at the Lowry Landfill Superfund Site,
Parsons, 2019

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19 November 2019

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Subject: **Results of the 1,4-Dioxane PQL Study in Groundwater at the Lowry Landfill Superfund Site**

Dear Ms. Kiefer,

On behalf of the City and County of Denver, Waste Management of Colorado, Inc., and Chemical Waste Management, Inc., hereafter referred to as the Work Settling Defendants (WSDs), Parsons is submitting this memorandum that presents results from a Site-specific Practical Quantitation Limit (PQL) Study that was performed in September 2019 at Lowry Landfill Superfund Site (the Site). The PQL study was conducted in accordance with the *Work Plan for Updating Site-Specific PQL for 1,4-Dioxane in Groundwater, Lowry Landfill Superfund Site (Parsons, August 6, 2019)* (Work Plan) that was approved by USEPA on August 28, 2019.

BACKGROUND

The PQL is defined as the minimum concentration of an analyte (substance) that can be measured with a high degree of confidence that the analyte is present at or above that concentration (Colorado Regulation 61 Section 61.2(78)). The process of determining a site-specific PQL for 1,4 dioxane in groundwater involved performance of a site-specific method detection limit (MDL) study that in turn, provides the basis for determining the site-specific PQL. The site-specific MDL, and therefore the site-specific PQL, are applicable only to Site groundwater (including Site-impacted groundwater north of the Site) and the specific method. The MDL is calculated from the standard deviation (variability) of the results of the known concentration samples from three laboratories, then multiplied by the Students t Value at the 99% confidence interval (3.143). The PQL is determined by multiplying the MDL by 10 as specified by CW6 Practical Quantitation Limits, Colorado Water Quality Control Commission effective February 3, 2015.

PROCEDURE

As described in the Work Plan, 1,4-Dioxane was analyzed using method EPA Method 8260 selected ion monitoring (SIM) isotope dilution (ID) by Eurofins (Arvada, CO), Pace Analytical (Madison, WI) and Summit Environmental (Summit) (Cuyahoga Falls, OH) to try to meet the Colorado Basic Standard for Groundwater (CBSG) for 1,4-dioxane of 0.35 ug/L. These labs were chosen because they can analyze 1,4-dioxane by SW8260 SIM-ID and were the only labs identified that routinely run this method. Experience has shown that the accuracy of SW8260 SIM-ID plus the low volume required for analysis is the most appropriate method for this analyte.

Groundwater from background well BKGD-3WD was spiked with three concentrations of 1,4-dioxane (0.4 ug/L, 0.8 ug/L, and 1.0 ug/L) for the MDL assessment. The lowest possible concentrations were chosen because higher concentrations are inherently more variable. These three concentrations are near the reporting limits of the selected laboratories.

The samples were spiked by Environmental Resource Associates (ERA) of Arvada, Colorado and prepared in one batch for each concentration. Seven replicates of each concentration were sent to each of three laboratories in three separate batches for analysis as summarized in Table 1. Note that ERA prepared each concentration in one batch that was then divided and sent to the laboratories on three separate days. This avoids variation caused when preparing different batches which would falsely inflate the MDL In theory, the MDL is calculated from the standard deviation of the pooled results from each set of 21 samples, then multiplied by the Students t Value at the 99% confidence interval (3.143). In that way the variability caused by analysis by different laboratories is incorporated into the MDL calculation as per 40CFR136 Appendix B. Unfortunately, the data from two of the labs was unacceptable and was excluded from the calculation. Problems with the data are explained below.

EVALUATION

For the 0.4 ug/L set of samples, Summit reported all samples as not detected; therefore, the 0.4 ug/L samples were excluded from the MDL calculation. For the 0.8 ug/L and 1.0 ug/L results by Summit, the signal to noise (S/N) ratios were 27 and 21, respectively. 40CFR136 requires the S/N ratio be between 10 and 20. This means the 0.8 ug/L and 1 ug/L samples are also excluded from use.

The Eurofins data had multiple problems. For the 0.4 ug/L samples, the variability in the data produced a S/N ratio of 1.5, which does not meet the 10 to 20 requirement. Also, no samples at this concentration were within the ERA acceptance limits of 0.28 – 0.52 ug/L. For the 0.8 ug/L and 1.0 ug/L samples, 71% and 42%, respectively were not within ERA limits. Finally, all three concentration sets were suspect because five of seven samples were qualified as U (not detected) in the validation for trip blank contamination. For these reasons, the Eurofins data were not used to calculate the MDL.

Pace Analytical was successful in analyzing the three sets of samples of differing concentrations. All results were within ERA acceptance limits with S/N ratios within 10 to 20 as required. Using only Pace data, the calculated MDLs were 0.09 ug/L (for 0.4 ug/L samples), 0.17 ug/L (0.8 ug/L samples), and 0.31 ug/L (1.0 ug/L samples). Because of the accuracy of the results at the lowest concentration, the MDL determined for the 0.4 ug/L sample set was chosen to represent the site-specific MDL (0.09 ug/L). It is interesting to note that if all data from the three laboratories were used, the MDL would equal 1.5, 0.46, and 0.57 ug/L for the 0.4, 0.8, and 1.0 ug/L sample sets, respectively. These MDLs are 3 to 16 times higher than the MDL determined by Pace Analytical alone.

The PQL for 1,4-dioxane is a multiplier of the calculated MDL and depends on the accuracy of the results for each standard concentration, the low standard used for calibration, differences of the standard deviations between each concentration group for each method, the accuracy of the quality control samples for the analytical run, and whether any standards are reported as not detected (i.e. if a 0.2 ug/L standard is reported as not detected consideration should be given the concentration of the PQL compared to the standard that wasn't detected). The PQL must also accommodate the variability between laboratories. Because we are

calculating the MDL using only the results from one laboratory (i.e. the MDL does not reflect variability from multiple laboratories), a multiplier of 10 was selected. This is also the multiplier specified by the Colorado State PQL Guidance. Therefore, The WSDs have set the PQL at a value of 0.9 ug/L.

There is no guidance or criteria for an acceptable range between the performance standard and the MDL; however, logic dictates that as the difference between the two becomes small, the overall uncertainty regarding any decisions that may be made based on values between the performance/compliance standard (that is based on the PQL) and the MDL becomes increasingly large. It would seem therefore, that in order to avoid false positives (i.e., determinations of an out-of-compliance condition when in actuality a particular well is in compliance) there needs to be some separation between the MDL and the performance/compliance standard for data sets where the majority of the results are less than the performance standard.

Sincerely,
PARSONS

Lyn Fitzgerald Brill

Project Manager

cc: Steve Richtel, WM
Tim Shangraw, EMSI
Dave Wilmoth, CCoD

Table 1

Results of PQL Study by Laboratory

Lab	Sample Conc (ug/L)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Standard Deviation by Lab	Mean	Signal to Noise Ratio	PACE only Pooled Std Dev	MDL	PQL at 10X Multiplier	ERA Cert Value	ERA Acceptance Limits
Pace	**0.4**	**0.41**	**0.43**	**0.48**	**0.49**	**0.43**	**0.44**	**0.45**	**0.0287**	**0.447**	**15**	**0.029**	**0.090**	**0.9**		
Eurofins	0.4	1.8	0.75	0.81	0.78	0.62	1.6	0	0.610	0.909	1.5				0.4	0.28-0.52
Summit	0.4	0	0	0	0	0	0	0	0	0	NA					
Pace	**0.8**	**0.83**	**0.9**	**0.95**	**0.9**	**0.94**	**0.82**	**0.83**	**0.0546**	**0.881**	**16**	**0.055**	**0.17**	**1.7**		
Eurofins	0.8	1	1.1	1	1.1	1.2	1.1	1.2	0.0816	1.1	13.				0.801	0.561-1.04
Summit	0.8	0.739	0.731	0.792	0.773	0.728	0.778	0.791	0.0282	0.762	27					
Pace	**1**	**1**	**1.1**	**1.2**	**1.2**	**1.2**	**1**	**1**	**0.1**	**1.1**	**11**	**0.1**	**0.314**	**3.1**	1	0.700-1.30
Eurofins	1	1.4	1.2	1.2	1.2	1.3	1.4	1.5	0.122	1.31	11					
Summit	1	0.906	0.851	0.921	0.929	0.913	0.877	0.986	0.0425	0.912	21					