**Invitation to the IAEA Proficiency Test for Nuclear and Related Analytical Techniques Laboratories (PTNATIAEA/21)**

Dear Madam/Sir:

The IAEA Nuclear Science and Instrumentation Laboratory (NSIL) invites you to take part in the worldwide proficiency test designed for the Nuclear and Related Analytical Techniques Laboratories involved in the analysis of various materials. Participating in a Proficiency Test is one of the most effective ways for a laboratory to monitor and assess its analytical performance. It can be used as a way to identify the results with unsuspected bias and to improve the quality of the analytical services provided.

The test involves distributing to participating laboratories (tentatively by the end of July 2023) a soil sample with elevated concentrations of elements and a plant sample with well-established homogeneity and composition. The laboratories are required to analyse the sample to determine the mass fraction of the elements found in the sample by following their established analytical procedures. The results must be uploaded into the PT website [www.pt-nsil.com](http://www.pt-nsil.com) by 1 December 2023 for further evaluation by NSIL according to recognized international procedures (ISO 17043 and ISO13528). All results will be treated as confidential and each laboratory participating in the exercise will receive a code known only by this laboratory.

An electronic copy of the final report of the proficiency test containing all the results submitted by the participants will be uploaded to the website [www.pt-nsil.com](http://www.pt-nsil.com) not later than 1 month after the deadline for submission of results. This report will be also published at a later date in the IAEA Analytical Quality in Nuclear Applications series. The reports from previous exercises are available for download at the home page of the website.

Based on the results of the proficiency test, each participating laboratory will be able to assess its analytical results in comparison with the specified standard of performance based on *z*-, *z’*- and *Zeta*-scores and, if appropriate, to identify discrepancies and to correct their analytical procedures.

We would be grateful if you accept the invitation to take part in the current proficiency test round. All necessary details on the material for the analysis and the instructions for registration and reporting the results are provided in the website. For additional information, feel free to contact the Proficiency Test Coordinator, Mr Alessandro Migliori by email at A.Migliori@iaea.org.

Thank you in advance for your positive response. Best regards.

Yours sincerely,

Ms Kanaki, Kalliopi

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**Instructions to participants of PTNATIAEA/21**

**Instructions for registration**

If you have never participated in a previous PTNATIAEA, you are kindly requested to get in contact with the PT coordinator, Mr Alessandro Migliori by sending an email to the address A.Migliori@iaea.org. You will receive a reply with instructions to register and log into the database functionalities.

If you have already participated in PTNATIAEA rounds, the information on your laboratory and yourself are already in the PT database. You can register/login to the PT database using your email address (you must define a password when registering). The database and its functionalities have been created under the assumption that **only one participant per laboratory will login into the PT database for the current PT round**, so you are kindly requested to confirm with your Laboratory Head whether you or some other of your colleagues will be appointed for the participation. In case you forgot your password, please write an email to A.Migliori@iaea.org.

**Proficiency test sample**

The proficiency test materials are a “soil sample with elevated concentrations of elements” and a “plant sample” with well-established homogeneity and composition. The reference values supplied by the provider of the material have been established by independent inter-laboratory surveys and are used as the assigned values *xpt* of the analytes. When not available, the assigned values for the proficiency assessment can be determined as consensus values of the results of the participants in the test, through the application of robust statistic methods.

**Due to the high content of elements in the soil samples (on the order of some hundreds of mg/kg), we recommend to always handle the sample carefully and wearing protective gloves and face mask.**

For each analyte the standard deviation for proficiency assessment *σpt* is determined using a modified Horowitz function *σR*[[1]](#footnote-1):

 $σ\_{pt}=σ\_{R}=\left\{\begin{array}{c}0.22x\_{pt} when x\_{pt}<1.2⋅10^{-7} \\0.02(x\_{pt})^{0.8495} when 1.2⋅10^{-7}\leq x\_{pt}\leq 0.138 \\0.01\sqrt{x\_{pt}} when x\_{pt}>0.138 \end{array}\right.$

**Instructions for the analysis and data uploading**

The moisture content in the sample may vary with a change in ambient humidity. Laboratories are therefore requested to determine the moisture content according to their routine procedure and to report all results on a dry-weight basis.

Following the indications of the provider of the material, the mass of the portions taken for the analysis (test portions or aliquots) should be at least 500 mg for the soil sample and 100 mg for the plant sample. In case a lower amount of sample will be used for the analysis, we recommend carrying out an additional homogenization of the material following your routine procedure.

Conduct the analysis according to your routine procedures. Bear in mind that this proficiency test is designed to evaluate the routine analysis procedure and not how well a laboratory could perform taking special precautions. This exercise is not intended for evaluating new procedures.

Provide one result only per element determined by using routine procedures. If your routine procedure involves reporting the average of two or more determinations, report the average. Please report the combined standard uncertainty estimate as uncertainty on the determined concentrations. Please pay attention to the unit for each element when uploading your results; bear in mind that units can be different for different elements.

**Interpretation of the results**

The PTNATIAEA uses the following statistical analysis[[2]](#footnote-2):

The reported result *xi* **for each element** is compared with the assigned values by using the *z*- or *z’-*score analysis, depending on whether the uncertainty of the assigned value *u*(*xpt*) is respectively lower or higher than the value 0.3*σpt*. The *z*- and *z’*-scores are calculated as:

 $z\_{i}=\frac{\left(x\_{i}-x\_{pt}\right)}{σ\_{pt}}$

 $z\_{i}^{'}=\frac{\left(x\_{i}-x\_{pt}\right)}{\sqrt{σ\_{pt}^{2}+u^{2}(x\_{pt})}}$

The conventional interpretation of *z*- or *z’*-scores is as follows[[3]](#footnote-3):

|*z*, *z’*| ≤ 2 the result is considered acceptable

2 < |*z*, *z’*| < 3 the result is considered to give a warning signal

|*z*, *z’*| ≥ 3 the result is considered to be unacceptable (or action signal)

Generally speaking, any *z*- or *z’*-score for an element outside the range -2 ≤ *z*, *z’* ≤ 2 should be examined by the analyst and all steps of the analytical procedure verified to identify the source(s) of the analytical bias.

The reported results are accompanied by the combined standard uncertainty estimate made by the participant. These values are used to calculate the *Zeta*-scores:

 $ζ\_{i}=\frac{x\_{i}-x\_{pt}}{\sqrt{u^{2}\left(x\_{i}\right)+u^{2}(x\_{pt})}}$

Where *u*(*xi*) is the participant’s own estimate of the combined standard uncertainty of its result *xi*. In principle, the same interpretation as described in the above for the *z*- and *z’*-scores may be applied to *Zeta*-scores.

1. Thompson, M. Recent trends in inter-laboratory precision at ppb and sub-ppb concentrations in relation to fitness for purpose criteria in proficiency testing. Analyst 2000, 125, 385-386, doi:10.1039/b000282h. [↑](#footnote-ref-1)
2. INTERNATIONAL ORGANIZATION FOR STANDARDIZATION, Statistical methods for use in proficiency testing by interlaboratory comparison, ISO 13528:2015, ISO, Geneva (2015). [↑](#footnote-ref-2)
3. INTERNATIONAL ORGANIZATION FOR STANDARDIZATION, Conformity assessment – General requirements for proficiency testing, ISO/IEC 17043:2010, ISO, Geneva (2010). [↑](#footnote-ref-3)