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The possibility of Applying the Requirements of Clause Seven of ISO/IEC 17025:2017 / A Case Study in the Inorganic Pollutants Laboratory at the Ministry of Science and Technology in Iraq

امكانية تطبيق متطلبات البند السابع للمواصفة ISO/IEC / 17025:2017 دراسة حالة في مختبر الملوثات اللاعضوية في وزارة العلوم والتكنولوجيا في العراق

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المستخلص:
يهدف هذا البحث الى اختبار إمكانية تطبيق البند السابع (متطلبات العملية) وفق المواصفة ISO/IEC 17025:2017 من اجل معرفة حجم الفجوة بين متطلبات البند السابع والواقع الفعلي في مختبر الملوثات اللاعضوية التابع لدائرة البيئة والمياه والطاقات المتجددة احدى تشكيلات وزارة العلوم والتكنولوجيا والذي تم اختياره كعينة بحثية، يعتمد البحث منهج دراسة حالة (case study) باستخدام قائمة الفحص(Check List) كأداة لجمع البيانات وتم استخدام الأساليب الإحصائية للحصول على نتائج البحث والمتمثلة (بالوسط الحسابي والنسبة المئوية لتحديد عدم المطابقة وحجم الفجوة الفعلي)، تضمنت قائمة الفحص على احد عشر محور وهي كالتالي (مراجعة الطلبات والمناقصات والعقود، اختيار الطرق والتحقق منها وإقرارها، اخذ العينات، مناولة عناصر الاختبار والمعايرة، السجلات التقنية، تقييم ارتياب القياس، ضمان صحة النتائج، تقرير النتائج، الشكاوى، العمل غير المطابق، التحكم في إدارة البيانات والمعلومات) والتي تندرج تحت البند السابع من المواصفة ISO/IEC 17025:2017 باستثناء بند (7.8.4 متطلبات محددة لشهادات المعايرة) كون المختبر لا يقوم بإصدار شهادات معايرة وذلك لان مجال عمله الاختبار وليس المعايرة. وتوصل البحث الى مجموعة من الاستنتاجات أهمها ان هنالك فجوة بين الواقع الفعلي للمختبر المبحوث وبين متطلبات بند العملية اذ بلغت الفجوة الكلية (25%) بينما بلغت نسبة المطابقة المئوية (75%)، كما وقدم البحث مجموعة من التوصيات اهمها اعتماد نتائج التقييم التي افرزتها قوائم الفحص وفقا لمتطلبات بند متطلبات العملية من اجل الوقوف على الواقع الفعلي للمختبر المبحوث وضرورة تبني تطبيق بند العملية.
الكلمات المفتاحية: المختبر ؛ ISO/IEC17025:2017؛ كفاءة المختبرات الفنية؛ مختبر الملوثات اللاعضوية؛ متطلبات العملية

Abstract :
This research aims to test the possibility of applying the seventh item (process requirements) according to the specification ISO/IEC 17025:2017 in order to see the size of the gap between the conditions of the seventh paragraph and the actual reality in the laboratory of inorganic pollutants of the department of environment, water and renewable energies, one of the formations of the ministry of science and technology, which was chosen as a research model, this research adopts a case study approach using the checklist as a tool for data collection, and statistical methods were used to obtain the search results, represented in (weighted arithmetic mean, percentage measurement, and gap size measurement), the examination list included eleven axes, which are as follows (review of requests, tenders and contracts, selection, verification and validation of methods, sampling, handling of test or calibration items, technical records, evaluation of measurement uncertainty, ensuring the validity of results, reporting of results, complaints, nonconforming work, control of data and information management), which are included under the seventh item of the standard ISO/IEC 17025:2017, except for item (7.8.4 specific conditions for calibration certificates) because the laboratory does not issue calibration certificates, because its field of work is testing and not calibration. The research reached a set of conclusions, the most important of which is that there is a gap between the actual reality of the research laboratory and the conditions of the process item, as the total gap reached (25%) while the percentage matching rate reached (75%), The research also presented a set of recommendations, the most important of which is adopting the evaluation results produced by the checklists in accordance with the requirements of the process requirements clause in order to determine the actual reality of the researched laboratory and the necessity of adopting the application of the process clause.

Keywords: Laboratory; ISO/IEC 17025:2017; Technical laboratory efficiency; Inorganic pollutants laboratory; Process requirements.

1- Introduction

Laboratories show a great and decisive role in many fields and sectors in the world, initial from the medical, chemical, engineering, technology, environmental, food and other sectors, they contribute to the elevation and progress of scientific and technological research, invention and improving the value of life, laboratories work to conduct experiments, tests, calibrations and analysis of results to recognize natural phenomena and improve processes and products, and at present-day the competence of laboratories and the value of test and calibration results is decisive and important for all industrial and service sectors that Looking forward to competing in global markets and so as to admit and accept the results of its tests locally and globally and increase confidence and reliability in its results among clients ,the international standard ISO/IEC 17025:2017 is capable of accomplishing this, which consist of the general standards for the competence of testing and standardization laboratories, as it is the reference standard and proof of compliance with native and international standards so as to prove neutrality, competence and reliability in test results and to prove technical and administrative competence and achieve credibility and reliability in laboratory results, So it is important to apply of applying ISO/IEC 17025:2017 in laboratories since it will ensure the existence of a laboratory that conducts its laboratory actions regularly and reliably, and ensures that its results are accepted locally. Globally (Putri et al., 2019: 1), the current research stems from the need of the Inorganic Pollutants Laboratory, one of the laboratories of the Department of Environment, Water and Renewable Energies, as it suffers from many difficulties, most remarkably the lack of an active management system according to the requests of ISO/IEC 17025:2017 and the weak wakefulness and awareness of the laboratory management in what the standard researched is, how to put on it and the benefits that add from it, and owing to the large number of standards of the standard studied, the seventh article (process requirements) was taken, the current research targets to test and analyze between the actual reality of the research laboratory and the requirements of the process item through a case study using checklists so as to determine the gap between the actual reality and the requirements of the process item According to ISO/IEC 17025:2017 in the research laboratory.

2. Research Methodology

2.1. Research problem

The fast changes and progresses in the business surroundings and the market have forced many challenges on organizations, as well as laboratories, which called for the need to use new means and methods according to these changes and challenges, as the laboratories should be technically and administratively competent and the outcomes of trials and calibration should be characterized by reliability, credibility and error-free to enhance confidence and credibility in the outcomes, so the Inorganic Pollutants Laboratory (research specimen) was chosen as one of the Laboratories of the Department of Environment, Water and Renewable Energies of the Ministry of Science and technology,via repetitive field visits to the research laboratory, it was found that there are several difficulties that the laboratory suffers from, most remarkably the laboratory's lack of an active management system according to ISO/IEC 17025:2017, as well as the lack of knowledge of what the standard researched by the laboratory management is, how to apply it and the advantages that accrue from it, as well as the wish of the research laboratory to obtain accreditation according to standard ISO/IEC 17025:2017 Therefore, the need arises for the research laboratory to adopt the research standard so as to be technically and administratively efficient, and its results are characterized by credibility and reliability with the client and free of errors, and for the large number of standards of the specification ISO/IEC 17025:2017, the seventh item (process requirements) has been taken, and accordingly, through the problem, a set of questions emerge as follows: -

A. What is the level of application of the Process requirements item according to ISO/IEC 17025:2017 in the Organic Pollutants Laboratory?
B. What is the size of the performance gap between the actual reality of the research laboratory and the item of Process requirements according to the standard ISO/IEC 17025:2017?

2.2. Importance of Research

A. The importance of this research came because it dealt with a vital and important sector that affects daily life, which is the laboratory for detecting inorganic pollutants and the possibility of its contribution in identifying the strengths and weaknesses of the laboratory's activities and procedures.
B. This research is a modest scientific contribution to improving and developing the performance of the research laboratory in the light of the realistic and digital evidence that the research results will reach.
C. The importance of research lies in educatingmanagement and laboratory staff of the requirements of item seven (process requirements) in accordance with ISO/IEC 17025:2017, its importance and how to apply it because of its impact on improving the quality of test results.
D. Supporting the inorganic pollutants laboratory in implementing an effective management system in accordance with the specifications ISO/IEC 17025:2017.

2.3. Aims of Research

A. Testing the applicability of the process requirements item according to ISO/IEC 17025:2017 in the Organic Pollutants Laboratory.
B. Measuring the size of the gap between the actual reality and the item of process requirements according to the standard ISO/IEC 17025:2017 in the research laboratory.

2.4 Research Approach

The recent research has relied the case study approach as the fitting approach to the research directions and reaching its aims, Through the use of many methods in collecting data, namely direct observations, field experience, meetings and dialogues with the inorganic pollutants laboratory official and workers, reviewing documents and records, as well as using the check list to collect data with the aim of arriving at scientific facts.

2.5. Community and specimen of research

A. Research Community: The Department of Environment, Water and Renewable Energies has been identified as one of the formations of the Ministry of Science and Technology.
B. Research specimen: As the choice was made on one of the laboratories of the department, which is the laboratory of inorganic pollutants.

2.6. Research Borders

A. Scientific borders : The standards of the seventh item (process requirements) along with the specification ISO/IEC 17025:2017.
B. Spatial borders: The Department of Environment, Water and Renewable Energies, represented by the Inorganic Pollutants Laboratory (Research specimen), which is one of the formations of the Ministry of Science and Technology to apply the research on the practical aspect This is because the work of the inorganic pollutants laboratory is consistent with the field of application of the standard ISO/IEC 17025:2017, which is testing and examining samples
C. Time limits: The time limits of the research are from 7/1/2024 - 29/1/2024 in which the researcher conducted field visits and personal interviews to identify the actual reality of the research laboratory.top or at the bottom of the page.

2.7. Data collection and analysis methods

The research relied on the heptathlon (Check List) scale to detect the level of applicability and documentation of the requirements of the process item according to ISO/IEC 17025:2017 in

the laboratory of inorganic pollutants, and the relative weights of (0-6) shown in Table (1) were determined and then the data were quantitatively analyzed and the results explained.

Table 1 Heptagonal scale

Sequence	Paragraphs Scale	Paragraph Weight
1	Fully applied fully documented	6
2	Fully Applied Partially Documented	5
3	Completely applied not documented	4
4	Partially applied, fully documented	3
5	Partially Applied Partially Documented	2
6	Partially Applied Not Documented	1
7	Not applicable Not documented	0

Source: Fadel, A. A., & Karim, A. A. W. A. (2022). Evaluation of the possibility of applying the Clauses of the specification (ISO 45001: 2018) in a number of formations of the Ministry of Construction and Housing/comparative research. *Journal of Techniques*, *4*(4), p.277.

The research also depended on a set of statistical ways to measure the conformity of the application and real documentation of the process requirements item according to ISO/IEC 17025:2017, and to measure the size of the gap between the standards and the actual reality of the researched laboratory, the following equations were adopted (Jumaa, & Khaleel, 2022: 137):-

A – Weighted arithmetic mean = ∑(frequencies x weights) / (∑frequencies) (1)

B - Matching percentage = (weighted mean / highest weight in the scale) 100% (2)

C - Gap size = 1 – percentage match (3)

2.8. Procedural definitions

A. Efficiency of technical laboratories: It is the technical competence that laboratories have to issue reliable and accurate results, through the use of modern and highly efficient technologies and devices, efficient human resources, and an appropriate work environment to provide the best tests to customers.

B. Specification ISO/IEC 17025:2017: An international specification issued by the organization IEC/ISO related to testing and calibration laboratories. It contains technical and administrative requirements, which laboratories must adopt to ensure the quality of their technical competence.

3. Theoretical aspect of research

3.1. Laboratory concept

The laboratory is denoted to (Harzli, 2021: 130) as "the figure that accomplishes one or more testing, calibration and sampling activities, linked with subsequent testing or calibration" while (Al-Shuraiqi, 2019: 75) the laboratory is "the fitting place to test and reveal activities using tools, materials and equipment within scientific measures to explore knowledge or validate certain laws or conclusions." (Jassam, 2023: 248) he defined it as "the organization in which experiments are conducted with certain features that contains All the necessary equipment and arrangements meet in theories to conduct calibrations, tests or sampling, in order to meet the standards and needs of scientific research in addition to serve the community in all its.

3.2. The concept and definition of technical laboratory efficiency

In order for laboratories to be technically competence, it is necessary to have quality control procedures so as to control the validity of calibration and tests carried out within the laboratory, and to record the data resulting from these procedures in a way that facilitates the detection of distribution patterns and trends, as well as the application of statistical techniques to review the results, and planning to monitor and review the results of quality control (Orabi, 2021: 10), it has been defined (Islek & Yukseloglu, 2018: 966) the efficiency of technical laboratories as "laboratories that best meet clients expectations, and provide the best service." It has a quality

system that contains audited documentation and is supported by proper maintenance, calibration, work instructions, a suitable laboratory environment, as well as current reference materials, constant quality control of tests and trained personnel" (Aqidawati & Zakaria, 2019: 3) He stated that laboratories performing testing and calibration must be accredited and compliant with the standards of ISO/IEC 17025 so as to ensure their technical competence.

3.3. Factors of efficiency of technical laboratories

The competence and technical excellence of laboratories rely on a set of factors that should be available in laboratories, including what he mentioned (Beckert, 2021: 1) as follows: -

1. Technical competence of employees.
2. Validity and appropriateness of measurement methods.
3. Uncertainty in measurement and appropriate application.
4. Suitability, calibration and maintenance of test equipment.
5. Test environment.
6. Sampling, handling and transportation of test items.
7. Ensure the quality of test, inspection and calibration data.
8. Traceability of measurement and calibration according to national standards.

3.4. Notion IEC/ISO 17025

Is the major standard for testing and calibration laboratories, and is part of the ISO 17000 / IEC standards, ISO 17025 (approved by the International Organization for Standardization (ISO) and the International Committee on Electrical Technology (IEC)) indicate standards for testing laboratories on how to conduct their activities in ways that warrant certain test results and comprehensive features of work in accordance with international standards (Ahola, 2019:14) ISO/IEC 17025 indicate the basic standards for verifying the competence of laboratories carrying out testing and calibration actions ‹specimens emphases on response clients predications then keeping the organization's laboratory registers and documents (Al-mijrab & Elgharib, 2019: 1), and addresses the general standard for performance, neutrality and constant operation of testing and calibration laboratories by concentrate on both the administrative and technical standard of laboratories, and laboratories that meet the standard of this standard have technical competence, and their test results are credible and reliable (Panagiotidou, 2023: 1), it has been defined (Krismastuti & Habibie, 2022: 359) as "an international standard applicable for testing and standard laboratories, containing all the standards necessary for laboratory management and ensuring that The measurements made in laboratories are valid, comparable and traceable, and compliance with them is one of the standards for obtaining accreditation status from the national accreditation body. (Gerônimo & Lenzi, 2023: 2) He described it as "a specification for laboratories to demonstrate their technical ability to produce valid and technically credible results of the expected trait.".

3.5. History of ISO/IEC 17025 versions

The standard so far contains three versions, the first version was published in 1999 and the last in 2005 and 2017 respectively (Ahola, 2019:14) It was shown (Miguel, 2019: 19) that the standard in its third and final version as an actual base Its origin comes from the guide issued in the last decades of the last century, which bears the title (ISO GUIDE 25) and contains guidelines for assessing the technical competence of testing laboratories, and it is the first document related to the current standard, as it has been Issuance of this guide by ILAC)) on the first of October 1978, and it included general guidelines for laboratories to prove their efficiency, and was reformulated in 1982, and continued to work until 1993 when a request was sent to the ISO / IEC by the European Technical Committee for Conformity Assessment after the failure of the manual on technical competence and accreditation of laboratories, and in 1994 CASCO decided to endorse the revision of the manual after meeting with stakeholders and accordingly the ISO / IEC 17025 specification was sequenced in the following versions:-

A. First Edition 1999: In 1999, the standard was published with its first title and currently in force ISO/IEC 17025 (General standards for Laboratory Efficiency), which contains the standards necessary to prove technical competence and validate data and reliable results of laboratory calibration (Andargie, 2019: 8).
B. Second version 2005: In 2005, the standard was amended to suit the modern version of the quality management system ISO 9001:2000, so the second version was issued amended by the competent committee, which integrated the ISO 17025 specification. Technical standards With the standards of the quality management system with one specification, as there were no fundamental differences between the 1999 and 2000 versions, the most important differences were the focus on continuous improvement of the quality management system and on establishing effective communications with the customer and using data to evaluate the performance of the quality management system and identify opportunities for improvement, ISO 17025:2005 included technical and administrative standards together (Krismastuti & Habibie, 2022: 360).
C. Third Edition 2017: In 2013, the standard was updated and revised in cooperation with ISO and the International Electrotechnical Commission (IEC) under the responsibility of the ISO/IEC Committee for Conformity Assessment (Ghernaout et al., 2018: 84) as ILAC, the International Laboratory Accreditation Organization, requested CASCO/ISO to conduct a comprehensive review of ISO / IEC 17025, which was issued in November 2017 after amending the overall format of the standard to be more in line with the new coordination directives applied in the ISO specification (Anastasopoulos, 2017: 30).

3.6. Benefits and advantages of ISO / IEC 17025

There are many benefits obtained by laboratories when applying ISO / IEC 17025 (Panhwar et al., 2020: 11) as follows: -

A. Reduce the cost of testing and examination.
B. National and international reputation and recognition.
C. Strong interaction between the laboratory and the customer.
D. Develop a laboratory approach and a systematic and professional operating environment.
E. Gain the trust of customers.
F. Improving the laboratory testing environment.
G. Document all testing activities in the laboratory.
H. Enhance self-confidence and employee confidence and abilities
I. Regular training courses for laboratory personnel.
J. The validity of test methods and the provision of accurate data.
K. Gain market share.
L. Well-organized work structure for laboratories, develop a culture of quality.

4. The practical side of the research

In this section, the results of the actual diagnosis of the application of the requirements of the process item (except for item 7.8.4 specific standards for calibration certificates) are presented according to ISO/IEC 17025:2017 using the examination list, as well as personal interviews with laboratory officials and employees and the actual observations made by the researcher to verify the appropriate information to fill it with the required information, and access to documents and records related to the Department of Environment, Water and Renewable Energies, represented by the Inorganic Pollutants Laboratory (research specimen), To know the arithmetic mean and the real rate of the extent of application of the standards of the seventh item (process requirements) subject of research and determine the application gap for all paragraphs of the examination list, as the item of process standards is divided into eleven items, which are as follows:-

7.1 Review of requests, tenders and contracts

Through Table (2), the results of the examination list show the level of application and documentation of the requirement (7.1), as the laboratory achieved an arithmetic mean of (5.3) out of (6) degrees, with a conformity rate of (88%), which indicates a non-identical rate and a gap of (12%) due to:-

1. The laboratory determines the standards of customers and documents them in a special record and in an understandable and clear manner for the employees.
2. The research laboratory has the resources and capacity to meet the standards of customers and selects the appropriate methods and procedures to achieve those standards.
3. The laboratory informs the customer when the test method requested by the laboratory is not suitable or not current. The laboratory works to resolve any disputes with the customer and deviations in his request before starting laboratory activities, but it lacks documentation.

Table 2 Checklist Requirement (7.1) Review of Applications, Tenders and Contracts

Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements (Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.1 Review of requests, tenders and contracts								
7.1.1 The laboratory must have a procedure for reviewing applications, tenders and contracts. The procedure should ensure that:								
A	The requirements are adequately defined, documented and understood.	✓						
B	The laboratory has the capability and resources to meet the requirements.	✓						
C	The appropriate methods or procedures are selected and are capable of meeting the customers' requirements.	✓						
7.1.2	The laboratory informs the client when the method requested by the client is considered inappropriate or not current.		✓					
7.1.3	When a customer requests a statement of conformity to a specification or standard for a test or calibration (eg: pass/fail, within tolerance/outside tolerance) the specification or standard and the decision rule must be clearly stated. Unless it is inherent in the required specifications or standards, the customer must be informed of the specific and agreed upon decision rule.	✓						
7.1.4	Any disagreements between the order or tender and the contract are resolved before laboratory activities begin. Each contract must be acceptable to the laboratory and the customer.			✓				
7.1.5	Any deviation from the contract is communicated to the customer.		✓					
7.1.6	If a contract is amended after work has commenced, the contract review shall be repeated and any amendments shall be communicated to all affected personnel.			✓				
7.1.7	Records of reviews, including any significant changes, shall be retained. Records shall also be retained of pertinent	✓						

	discussions with a customer relating to the customer's requirements or the results of the laboratory activities.							
Repetitions		5	2	2	0	0	0	0
Result		30	10	8	0	0	0	0
Weighted arithmetic mean = (score / sum of frequencies)		5.3						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%88						
Gap size = 1-percentage		%12						

7.2 Selection, verification and validation s of method

Through Table (3), the results of the examination list are clear The level of application and documentation of the requirement (7.2) as the laboratory achieved an arithmetic mean of (3.1) out of (6) degrees, with a conformity rate of (52%), which indicates the existence of a non-identical rate and a gap of (48%) due to:-

1. The laboratory uses appropriate methods and procedures for all laboratory activities carried out by it and depends on the versions of the Iraqi Central Organization for Standardization and Quality Control or on Catalog of the manufacturer of the device or sober scientific books.
2. The laboratory sometimes modifies the methods as needed, and also approves the methods and verifies their validity before working with them, but the documentation is weak and is in the form of drafts and not in a special record .
3. There is a failure to document the procedures for approving roads, it does not have special and clear records that include road verification procedures, standards specifications, road performance characteristics, and a statement of the validity of the roads and their suitability for use.

Table 3 Checklist Requirement (7.2) Selection, Verification and Approval of Methods

Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements(Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.2 Selection, verification and validation s of methods								
7.2.1 Selection and verification of methods								
7.2.1.1	The laboratory uses appropriate methods and procedures for all laboratory activities, to assess measurement uncertainty as well as statistical techniques to analyze data where appropriate.	✓						
7.2.1.2	All methods, procedures and supporting documentation, such as instructions, standards, manuals and reference data relevant to laboratory activities, are updated and made available to staff.					✓		
7.2.1.3	The laboratory ensures that the latest correct version of the method is used unless it is appropriate or possible to do so. where necessary, the application of the method is completed with additional details to ensure consistent application.	✓						
7.2.1.4	When the client does not specify which method to use, the tester selects the appropriate method and informs the client of the chosen method.	✓						
7.2.1.5	The laboratory verifies that the methods can be properly performed before they are submitted by ensuring that the required performance is achieved and verification records must be kept. if the method is revised by the issuing body, the verification is repeated to the extent necessary.		✓					
7.2.1.6	When method development is required, this shall be a planned activity and shall be assigned to competent personnel equipped with adequate resources. as method development proceeds, periodic review shall be carried out to confirm that the needs of the customer are still being fulfilled. any modifications to the development plan shall be approved and authorized.		✓					
7.2.2 Validation Of Methods								
7.2.2.1	The laboratory verifies the validity of non-standard methods, methods developed in laboratories and standard methods used outside their specified scope or otherwise modified. validation is broad enough to meet the needs of a particular application or application area.		✓					

7.2.2.2	The performance characteristics of approved methods, as evaluated for the specific use, are appropriate to customer needs and consistent with specified requirements.		✓					
7.2.2.4 The Laboratory Shall Retain The Following Records Of Validation:								
A	Verification procedures used.							✓
B	Requirements Specifications.							✓
C	Determination of the performance characteristics of the method							✓
D	Results obtained.							✓
E	A Statement on the validity of the method, detailing its fitness for the intended use.							✓
Repetitions		3	4	0	0	1	0	5
Result		18	20	0	0	2	0	0
Weighted arithmetic mean = (score / sum of frequencies)		3.1						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%52						
Gap size = 1-percentage		%48						

7.3 Sampling

Through Table (4) shows the results of the examination list The level of application and documentation of the requirement (7.3) as the laboratory achieved an arithmetic mean of (5.1) out of (6) degrees, with a conformity rate of (85%), which indicates a non-identical rate and a gap of (15%) due to the fact that the laboratory has a method and plan for sampling and includes the type of specimen chosen, locations and method of taking the specimen, as well as keeping records of the sampling data, which includes the method of taking the specimen, its date, the individuals who take the specimen and the circumstances. However, the records do not contain deviations, additions or exceptions to the sampling method.

Table 4 Checklist Requirement (7.3) Sampling

Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements(Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.3 Sampling								
7.3.1: The laboratory has a plan and method for taking samples								
-	When it takes specimens of materials or products for calibration or subsequent tests.	✓						
-	The sampling method addresses the factors that need to be controlled to ensure the correctness of calibration results or subsequent tests.	✓						
-	The sampling plan and method shall be available at the location where the specimen are taken							✓
7.3.2 The sampling method describes the following:								
A	The selection of samples or sites.	✓						
B	The sampling plan.	✓						
C	The preparation and treatment of sample(s) from a substance, material or product to yield the required item for subsequent testing or calibration.	✓						
7.3.3 The laboratory shall keep records of the sampling data that are part of the test or calibration performed. Such records shall, where appropriate:								
A	Reference to the sampling method used.	✓						
B	Date and time of sampling.	✓						
C	Data to identify and describe the sample (e.g. Number, amount, name).	✓						
D	Identification of the personnel performing sampling.	✓						
E	Identification of the equipment used.	✓						
F	Environmental or transport conditions.	✓						
G	Diagrams or other equivalent means to identify the sampling location, when appropriate.	✓						
H	Deviations, additions to or exclusions from the sampling method and sampling plan.							✓
Repetitions		12	0	0	0	0	0	2
Result		72	0	0	0	0	0	0
Weighted arithmetic mean = (score / sum of frequencies)		5.1						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%85						
Gap size = 1-percentage		%15						

7.4 Handling of test or calibration items

Through Table (5), the results of the examination list show the level of application and documentation of the requirement (7.4) as the laboratory achieved an arithmetic mean of (5.6) out of (6) scores, with a conformity rate of (93%), which indicates a non-identical rate and a gap of (7%) due to: -

1. The laboratory has a procedure for transporting test items, receiving them from the customer, handling and preserving them, as well as how to dispose of them, but there is weakness and partial application in documentation.
2. The laboratory works to distinguish the test elements and not confuse them physically and when recording them in the records.
3. The laboratory records deviations from the conditions upon receipt of the items to be tested by the customer

Table 5 Checklist Requirement (7.4) Handling of Test and Calibration Items

Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements(Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.4 Handling of test or calibration items								
7.4.1	The laboratory shall have a procedure for transporting, receiving, handling, protecting, storing, retaining, returning or disposing of test or calibration items, including all standards necessary to maintain the integrity of the test or calibration element, and protecting the interests of the laboratory and the customer. Precautions are taken to avoid deterioration, contamination, loss or damage to the item during handling, transportation, storage/waiting and preparation for testing or calibration. The handling instructions provided with the item are followed.		✓					
7.4.2 The laboratory shall:								
A	The laboratory has an unambiguous system for marking test or calibration elements and discrimination is maintained while the elements are under the responsibility of the laboratory	✓						
B	The system ensures that items are not confused physically or when referenced in records or other documents	✓						
7.4.3 Upon receipt of the items to be tested or calibrated, the laboratory shall:								
A	Recording deviations from specified conditions.	✓						
B	When there is doubt about the suitability of the item for testing or calibration, or that the item does not conform to the given description, the tester will consult the customer for further instructions before proceeding and record the results of this consultation.		✓					
7.4.4	When items need to be stored or numbered under specific environmental conditions, these conditions are maintained, monitored and recorded.	✓						
Repetitions		4	2	0	0	0	0	0
Result		24	10	0	0	0	0	0
Weighted arithmetic mean = (score / sum of frequencies)		5.6						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%93						
Gap size = 1-percentage		%7						

7.5 Technical records

Through Table (6), the results of the examination list show the level of application and documentation of the requirement (7.5) as the laboratory achieved an arithmetic mean of (4.6) out of (6) degrees, with a conformity rate of (77%), which indicates a non-identical rate and a gap of (23%) due to:-

1. The laboratory does not have technical records for all laboratory activities, and it has records of some activities such as records of receiving specimens from the customer, records of results and reports.
2. The records it possesses are clear and include the date, identity of the responsible staff, verification of data, results and calculations, and the laboratory follows up on modifications to the technical records it has on previous versions or original notes, and keeps the original and modified records together.

Table 6 Requirement Checklist (5.7) Technical Records

Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements(Process requirements(	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.5 Technical records								
7.5.1 The laboratory shall ensure that::								
A	The laboratory shall ensure that the technical records of each laboratory activity contain the results, report and information sufficient to facilitate, if possible, the identification of factors affecting the measurement result and associated measurement uncertainties and to enable the replication of laboratory activity under conditions as close as possible to the original.					✓		
B	Technical records include the history and identity of the personnel responsible for each laboratory activity and for verifying data and results.	✓						
7.5.2	The laboratory shall ensure that amendments to technical records can be tracked to previous versions or to original observations. Both the original and amended data and files shall be retained, including the date of alteration, an indication of the altered aspects and the personnel responsible for the alterations.	✓						
Repetitions		2	0	0	0	1	0	0
Result		12	0	0	0	2	0	0
Weighted arithmetic mean = (score / sum of frequencies)		4.6						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%77						
Gap size = 1-percentage		%23						

7.6 Evaluation of measurement uncertainty

Through Table (7), the results of the examination list show the level of application and documentation of the requirement (7.6) as the laboratory achieved an arithmetic mean of (5) out of (6) degrees, with a conformity rate of (83%), which indicates a non-identical rate and a gap of (17%) due to the fact that the research laboratory identifies the factors contributing to the measurement uncertainty and takes into account all factors when evaluating the measurement uncertainty, such as those mentioned in the device catalog, and sometimes the technical factor estimates it according to His technical expertise but with poor and partial documentation. Table 7 Requirement Checklist (6.7) Measurement Uncertainty Assessment

Table 7 Requirement Checklist (6.7) Evaluation of measurement uncertainty

Checklist for conformity with standard requirements IEC/ISO17025:2017		the scale						
	Specification requirements(Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.6 Evaluation of measurement uncertainty								
7.6.1 The laboratory shall :								

A	Laboratories identify factors contributing to measurement uncertainty.		✓					
B	In assessing measurement uncertainty, all significant contributing factors, including those arising from sampling using appropriate analysis methods, are taken into account.		✓					
7.6.2	The laboratory performing the calibrations (including its own equipment) assesses the measurement uncertainty of all calibrations.		✓					
7.6.3	The laboratory performing the tests evaluates the measurement uncertainty and when the test method prevents the accurate evaluation of the uncertainty measured, an estimate is made on the basis of an understanding of the theoretical principles or practical experience of the method performance		✓					
Repetitions		0	4	0	0	0	0	0
Result		0	20	0	0	0	0	0
Weighted arithmetic mean = (score / sum of frequencies)		5						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%83						
Gap size = 1-percentage		%17						

7.7 Ensuring the validity of results

Through Table (8), the results of the examination list show the level of application and documentation of the requirement (7.7) as the laboratory achieved an arithmetic mean of (4.5) out of (6) degrees, with a conformity rate of (75%), which indicates a non-identical rate and a gap of (25%) due to :-

1. The laboratory works to monitor the validity and guarantee the results through several methods and record the results in a way that can know the direction of the results flow.
2. There is a failure of the laboratory management to participate in comparisons between laboratories and monitor its performance compared to the results of other laboratories, or participate in the proficiency test outside the laboratory continuously to know the efficiency of its performance, only once participated in the proficiency test organized by the Chinese Accreditation Authority in cooperation with the Iraqi Central Agency and passed the test successfully

Table 8 Checklist Requirement (7.7) Ensuring the validity of results

Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements(Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.7 Ensuring the validity of results								
The laboratory ensures that								
7.7.1	The laboratory shall have a procedure for monitoring the validity of results. The resulting data shall be recorded in such a way that trends are detectable and, where practicable, statistical techniques shall be applied to review the results. This monitoring shall be planned and reviewed and shall include, where appropriate, but not be limited to:		✓					
A	Use Of Reference Materials Or Quality Control Materials	✓						
B	Use of alternative instrumentation that has been calibrated to provide traceable results	✓						
C	Use of check or working standards with control charts, where applicable	✓						
D	Replicate tests or calibrations using the same or different methods	✓						
E	Retesting or recalibration of retained items	✓						
F	Correlation of results for different characteristics of an item	✓						
G	Review of reported results	✓						
H	Intralaboratory comparisons		✓					
I	Testing of blind sample(s)		✓					
7.7.2 The laboratory shall monitor its performance against the results of other laboratories, where available and appropriate, and such monitoring shall be planned and reviewed, and shall include, but is not limited to, any of the following::								

A	Participation in proficiency testing						✓	
B	Participation in interlaboratory comparisons other than proficiency testing							✓
7.7.3	Analyze data from monitoring activities and, if possible, use them to adjust and improve laboratory activities. If the results of the analysis of data from monitoring activities are found to be outside predetermined criteria, appropriate action must be taken to prevent incorrect results from being reported						✓	
Repetitions		7	3	0	0	0	2	1
Result		42	15	0	0	0	2	0
Weighted arithmetic mean = (score / sum of frequencies)		4.5						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%75						
Gap size = 1-percentage		%25						

7.8 Reporting of results

Through Table (9), the results of the examination list show the level of application and documentation of the requirement (7.8), as the laboratory achieved an arithmetic mean of (5.4) out of (6) scores, with a conformity rate of (90%), which indicates the existence of a non-identical rate and a gap of (10%) that returns to the

1. Laboratory, adjusts the results report and reviews it before issuance and keeps the reports in a special record.
2. The report issued by the research laboratory includes most of the standards contained in the two standards (7.8.2 and 7.8.3) with regard to test reports, and the laboratory also has reports on sampling, conformity statement, opinions and interpretations, and most of the standards mentioned in the item include only some standards that the report does not meet, such as environmental conditions for the test and sampling report or information on the assessment of measurement uncertainty for the sampling report.
3. The laboratory does not keep a special record of the dialogue between the laboratory and the client when opinions and interpretations are communicated directly and through the dialogue.

Table 9 Checklist Requirement 7.8 Reporting of results

Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements(Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.8 Reporting of results								
7.8.1 General								
7.8.1.1	Results are reviewed and approved before they are released	✓						
7.8.1.2 The laboratory shall present the results accurately, clearly, objectively and unambiguously, usually in a report (such as a test report, or sampling report), and shall include :								
A	All information agreed upon with the client and necessary to interpret the results and all information required through the method used	✓						
B	All outgoing reports are kept as technical records	✓						
7.8.1.3	When agreed with the customer, the results may be communicated in a simplified manner. Any information listed in 7.8.2 through 7.8.7 that is not reported to the customer should be readily available	✓						
7.8.2 Common requirements for reports (test, or sampling)								
7.8.2.1 Each report shall include at least the following information, unless the laboratory has valid reasons for not doing so, thereby minimizing any possibility of misunderstanding or misuse::								
A	A title (e.g. “test report”, “calibration certificate” or “report of sampling”)	✓						
B	The name and address of the laboratory	✓						
C	The location of performance of the laboratory activities, including when performed at a customer facility or at sites away from the	✓						

	laboratory's permanent facilities, or in associated temporary or mobile facilities							
D	The name and contact information of the customer	✓						
E	Identification of the method used	✓						
F	The date of receipt of the test or calibration item(s), and the date of sampling,where this is critical to the validity and application of the results;	✓						
G	The date(s) of performance of the laboratory activity	✓						
H	The date of issue of the report;	✓						
I	The results with, where appropriate, the units of measurement;	✓						
J	Identification of the person(s) authorizing the report;					✓		
K	Clear identification when results are from external providers	✓						
7.8.2.2 The laboratory shall: :								
A	The laboratory is responsible for all information contained in the report, except where the client provides the information	✓						
B	In cases where the laboratory was not responsible for the sampling phase (e.g. the specimen was provided by the customer), the report states that the results apply to the specimen as received	✓						
7.8.3 Specific requirements for test reports								
7.8.3.1 In addition to the requirements listed in 7.8.2, test reports shall, where necessary for the interpretation of the test results, include the following::								
A	Information on specific test conditions, such as environmental conditions	✓						
B	Where relevant, a statement of conformity with requirements or specifications	✓						
C	Where applicable, the measurement uncertainty presented in the same unit as that of the measurand Or in a term relative to the measurand (e.g. Percent) when: — it is relevant to the validity or application of the test results; — a customer's instruction so requires, or — the measurement uncertainty affects conformity to a specification limit	✓						
D	Where appropriate, opinions and interpretations	✓						
E	Additional information that may be required by specific methods, authorities,customers or groups of customers	✓						
7.8.3.2	Where the laboratory is responsible for the sampling activity, test reports shall meet the requirements listed in 7.8.5 where necessary for the interpretation of test results	✓						
7.8.5 Sampling –Specific Requirements Reporting								
Where the laboratory is responsible for the sampling activity, in addition to the requirements listed in 7.8.2, reports shall include the following, where necessary for the interpretation of results:								
A	The date of sampling	✓						
B	Unique identification of the item or material sampled (including the name of the manufacturer, the model or type of designation and serial numbers, as appropriate)	✓						
C	The location of sampling, including any diagrams, sketches or photographs;	✓						
D	A reference to the sampling plan and sampling method							
E	Details of any environmental conditions during sampling that affect the interpretation of the results							✓
F	Information required to evaluate measurement uncertainty for subsequent testing or calibration							✓
7.8.6 Reporting statements of conformity								
7.8.6.1	When a statement of conformity to a specification or standard is provided, the laboratory shall document the decision rule employed, taking into account the level of risk (such as false accept and false reject and statistical assumptions) associated with the decision rule employed, and apply the decision rule.	✓						
7.8.6.2 The laboratory shall report on the statement of conformity, clearly specifying: :								
A	To which results the statement of conformity applies	✓						
	Which specifications, standards or parts thereof are met or not met	✓						
B	The decision rule applied (unless it is inherent in the requested specification or standard)	✓						

7.8.7 Reporting opinions and interpretations								
7.8.7.1	When opinions and interpretations are expressed, the laboratory ensures that only the staff authorized to express opinions and interpretations submit the relevant statement. The laboratory documents the basis on which the opinions and interpretations were based	✓						
7.8.7.2	The opinions and interpretations expressed in reports shall be based on the results obtained from the tested or calibrated item and shall be clearly identified as such.	✓						
7.8.7.3	When opinions and interpretations are directly communicated by dialogue with the customer, a record of the dialogue shall be retained.							✓
7.8.8 to reports Amendments								
7.8.8.1	When an issued report needs to be changed, amended or re-issued, any change of information shall be clearly identified and, where appropriate, the reason for the change included in the report.	✓						
7.8.8.2	Amendments to a report after issue shall be made only in the form of a further document, or data transfer, which includes the statement "Amendment to Report, serial number… [or as otherwise identified]", or an equivalent form of wording	✓						
7.8.8.3	When it is necessary to issue a complete new report, this shall be uniquely identified and shall contain a reference to the original that it replaces.	✓						
Repetitions		34	0	0	0	1	0	3
Result		204	0	0	0	2	0	0
Weighted arithmetic mean = (score / sum of frequencies)		5.4						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%90						
Gap size = 1-percentage		%10						

7.9 Complaints

Through Table (10) the results of the examination list show the level of application and documentation of the requirement (7.9) as the laboratory achieved an arithmetic mean of (3.4) out of (6) scores, with a conformity rate of (57%), which indicates a non-identical rate and a gap of (43%) due to:-

1. The laboratory does not have a documented procedure that describes the process of how to receive complaints from customers,
2. the laboratory is keen to address complaints if received from the customer in some way and works to verify the complaint whether it is related to its activities or No, but with poor documentation

Table 10 Checklist Requirement (7.9) Complaints

Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements(Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.9 Complaints								
7.9.1	The laboratory has a documented process for receiving, evaluating and deciding on complaints						✓	
7.9.2	A description of the complaints handling process is available to any interested party upon request. Upon receipt of the complaint						✓	
-	The laboratory confirms whether the complaint relates to laboratory activities for which it is responsible and, if so, it should deal with it			✓				
-	The laboratory is responsible for all decisions at all levels of complaint handling					✓		
7.9.3 The process for handling complaints shall include at least the following elements and methods:								
A	Description Of The Process For Receiving, Validating, Investigating The Complaint, And Deciding What Actions Are To Be Taken In Response To It						✓	

B	Tracking And Recording Complaints, Including Actions Undertaken To Resolve Them		✓					
C	Ensuring That Any Appropriate Action Is Taken		✓					
7.9.4	The laboratory receiving the complaint is responsible for collecting and verifying all the information necessary to validate the complaint	✓						
7.9.5	The laboratory acknowledges receipt of the complaint when possible and provides the complainants with progress reports and the final result.				✓			
7.9.6	The results communicated to the complainant shall be from individuals who are not involved in the original laboratory activities concerned or reviewed and approved			✓				
7.9.7	The laboratory gives formal notice of the end of complaint processing to the complainant whenever possible		✓					
Repetitions		1	3	2	1	1	3	0
Result		6	15	8	3	2	3	0
Weighted arithmetic mean = (score / sum of frequencies)		3.4						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%57						
Gap size = 1-percentage		%43						

7.10 Nonconforming work

Through Table (11), the results of the examination list show the level of application and documentation of the requirement (7.10) as the laboratory achieved an arithmetic mean of (4) out of (6) degrees, with a conformity rate of (67%), which indicates the existence of a non-identical rate and a gap of (33%) due to :-

1. The laboratory management determines those responsible for managing the non-identical work, which is the official of the inorganic pollutants laboratory and has the powers to stop or accept work and treat non-identical work, as well as resume work after treatment, but it There is a lack of documentation.
2. The laboratory does not keep records of non-identical work procedure .
3. The laboratory takes corrective action when the evaluation of non-identical work indicates that it can be repeated or there is doubt about the compatibility of laboratory processes with the management system and the lack of documentation of these procedures. Table 11 Requirement Checklist (7.10) non-identical work

Table 11 Requirement Checklist (7.10) non-identical work

Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements(Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.10 Nonconforming work								
7.10.1 The laboratory shall have a procedure that shall be implemented when any aspect of its laboratory activities or results of this work do not conform to its own procedures or the agreed requirements of the customer (e.g. equipment or environmental conditions are out of specified limits, results of monitoring fail to meet specified criteria). The procedure shall ensure that::								
A	the responsibilities and authorities for the management of nonconforming work are defined	✓						
B	Actions (including stopping or repeating work and stopping reporting as necessary) are based on risk levels determined by the laboratory			✓				
C	Conduct an assessment of the significance of non-identical work including an impact analysis on past findings			✓				
4	a decision is taken on the acceptability of the nonconforming work.			✓				
D	where necessary, the customer is notified and work is recalled.		✓					
E	The responsibility for the authorization is determined by the resumption of work		✓					
7.10.2	The laboratory keeps records of non-identical actions and procedures specified" in 7.10.1 items (b to h)							✓

7.10.3	Where the evaluation indicates that the nonconforming work could recur, or that there is doubt about the conformity of the laboratory's operations with its own management system, the laboratory shall implement corrective action			✓				
Repetitions		1	2	4	0	0	0	1
Result		6	10	16	0	0	0	0
Weighted arithmetic mean = (score / sum of frequencies)		4						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%67						
Gap size = 1-percentage		%33						

7.11 Control of data and information management

Through Table (12) the results of the examination list show the level of application and documentation of the requirement (7.11) as the laboratory achieved an arithmetic mean of (3.3) out of (6) scores, with a conformity rate of (55%), which indicates a non-identical rate and a gap of (45%) due to: -

1. The laboratory has access to data and information related to the performance of its laboratory activities.
2. The laboratory does not have a written and documented procedure for its information management system (LIMS) and unified for all data and information of laboratory activities ,there is a partial application for managing data and information of laboratory activities
3. The laboratory manages its information in a traditional and paper manner, but it is keen to protect and maintain its information from tampering and loss and is easy to obtain by workers to perform laboratory activities.

Table 12 Checklist Requirement (7.11) Data and Information Management Control

. Checklist for conformity with standard requirements ISO/IEC17025:2017		the scale						
	Specification requirements(Process requirements)	Fully applied fully documented	Fully Applied Partially Documented	Completely applied not documented	Partially applied, fully documented	Partially Applied Partially Documented	Partially Applied Not Documented	Not applicable Not documented
		6	5	4	3	2	1	0
7.11 Control of data and information management								
7.11.1	The laboratory has access to data and information necessary to perform laboratory activities	✓						
7.11.2	The laboratory information management system used to collect, process, record, report, store or retrieve data including the proper operation of the interface functions within the information management system is validated by the laboratory prior to use. When there are any changes including laboratory software configuration or modifications to off-the-shelf commercial software, they are authorized, documented and validated prior to implementation.					✓		
7.11.3 Laboratory Information Management System Formation								
A	Protected from unauthorized access			✓				
B	Protected from tampering and loss			✓				
C	They run in an environment that conforms to the specifications of the provider or tester or in the case of non-computerized systems that provide conditions that guarantee the accuracy of manual recording and copying			✓				
D	They are maintained in a way that ensures the integrity of data and information..			✓				
E	Includes system failure logging and appropriate immediate and corrective actions						✓	
7.11.5	The laboratory shall ensure that instructions, manuals and reference data relevant to the laboratory information management system(s) are made readily available to personnel						✓	

7.11.6	Calculations and data transfers shall be checked in an appropriate and systematic manner			✓				
Repetitions		1	0	5	0	1	2	0
Result		6	0	20	0	2	2	0
Weighted arithmetic mean = (score / sum of frequencies)		3.3						
Matching percentage = (weighted mean / highest weight in the scale) 100%		%55						
Gap size = 1-percentage		%45						

It is clear from Table (13) the results of the examination of the standards of item (7.process standards) that the total application ratio reached (75%) and the gap to the conformity ratio reached (25%), as Clause (7.4 Handling of test or calibration items) recorded the highest conformity rate of (93%), while item (7.2 Selection, verification and validation of methods) recorded the lowest conformity rate of (52%), thus requiring the Inorganic pollutants laboratory to enhance its positive aspects and seek to remove Negative sides.

Table 13 The overall results of the process standards item

Sequence	Overall results for the process requirements item		Evaluation scores for actual application and documentation		
	Requirement number	Requirement name	Weighted arithmetic mean	Matching percentage	Gap size
1	7.1	Review of requests, tenders and contracts	5.3	%88	%12
2	7.2	Selection, verification and validation of methods	3.1	%52	%48
3	7.3	Sampling	5.1	%85	%15
4	7.4	Handling of test or calibration items	5.6	%93	%7
5	7.5	Technical records	4.6	%77	%23
6	7.6	Evaluation of measurement uncertainty	5	%83	%17
7	7.7	Ensuring the validity of results	4.5	%75	%25
8	7.8	Reporting of results	5.4	%90	%10
9	7.9	Complaints	3.4	%57	%43
10	7.10	Nonconforming work	4	%67	%33
11	7.11	Control of data and information management	3.3	%55	%45
Total matching ratio and gap size				%75	%25

5. Conclusions and Recommendations

5.1 Conclusions

1. There is a gap between the actual fact of the inorganic pollutants laboratory and the process requirements item, as the overall gap reached (25%), and this gap is owing to many reasons that have been diagnosed, and the percentage of application and documentation (75%) and that percentage is due to the interest of the research laboratory to put on these demands and has been mentioned .
2. The research laboratory has a special register of clients demands that is clear and understandable to its workers, and the laboratory maintains records of reviews and discussions that are with the client concerning its demands or results Laboratory actions
3. The research laboratory is keen on choosing fitting ways and procedures capable of addressing the demands of clients and rely on the versions of the Iraqi Central Organization for Standardization and Quality Control or on the manufacturer's catalog of the device or sober scientific books.
4. The laboratory verifies the validity of test methods before approving and approving them, but it lacks documentation.
5. The laboratory depends on a specific and appropriate method and plan depending on the type of sample, whether it is soil, food, or water, when taking the samples.
6. The laboratory is ready to save the test elements from damage, retrogression and loss through a special method for receiving, treatment and preserving the elements from the customer, and distinguishes the elements with special markings for each factor to stave off chaos between them, but there is a lack in documentation.

7. The laboratory does not have technologic register for all ISO/IEC 17025:2017 laboratory actions, it has some register such as client standard register and register of reports and results.
8. The laboratory evaluates the measurement uncertainty of its devices and equipment and identifies the factors contributing to the measurement uncertainty and takes them into account when measuring the uncertainty, whether those it mentions as the device's behavior or those that are determined by workers based on their technical expertise..
9. The laboratory does not participate in proficiency testing or participate in comparisons between its performance and the performance of other laboratories in terms of test efficiency and validity of results.
10. It does not have a documented procedure that clearly describes the process of receiving complaints from customers.
11. The research laboratory has an interest in processing non-identical work, but without documentation and does not have special records to document everything related to non-identical work.

5.2. Recommendations

1. Approving the assessment results formed by the test lists according to the requirements of the process standards item so as to determine the actual reality in the researched laboratory, to develop the positive features that have attained the highest rates of application and documentation, and to search for to remove the negative features that have reached the lowest percentage of application and documentation, and the need to approve the requirements of the manner item in accordance with ISO/IEC 17025:2017, as well as the availability of the necessary support from senior management to adopt these requirements, so as to assess the act of the laboratory and then cover the way To apply all the requirements of the standard surveyed to obtain accreditation
2. The laboratory must create special records to document everything related to the process of validating and approving test methods..
3. Paying greater attention to documenting the procedure for handling test items when they are handled and received by the customer.
4. The research laboratory ought to work on making technical records for all laboratory actions carried out by it, to maintain the consistency and accuracy of work and avoid mistakes when the workers carry out the activities of the laboratory.
5. The research laboratory ought to work on making technical registers for all laboratory activities carried out by it, to keep the consistency and correctness of work and avoid faults when the workers carry out the activities of the laboratory.
6. The laboratory ought to participate in the proficiency test at accredited bodies to know its performance and efficiency in conducting tests, as well as it must compare its results with the results of other laboratories (inside or outside) in testing the elements to recognize the correctness of the tests it conducts.
7. Create and configure a documented procedure that describes the process of receiving customer complaints, how to verify their validity, and determine what actions should be taken to respond to customer complaints.
8. Care to recording non-identical work procedures and keeping special records of non-identical work and corrective actions taken to address non-identical work.

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Reference

1- Jassam, Anfal Hadi (2023) "The possibility of applying the technical requirements clause according to ISO 15189:2012 in Sama Al-Wathiq Al-Ahly Laboratory / a case study" Warith Scientific Journal, Volume 5, Issue 14.

2- Panagiotidou, E. (2023),"Strategic management of accredited testing laboratories according to ISO 17025: Investigating the relationship between accreditation and laboratory competence" , Master in Business Administration, School of Social Sciences, Patras, Greece.

3- Geronimo, B. M., & Lenzi, G. G. (2023). Maturity Models for Testing and Calibration Laboratories: A Systematic Literature Review. *Sustainability*, *15*(4), 3480.. ; **https://doi.org/10.3390/su15043480**

4- Fadel, A. A., & Karim, A. A. W. A. (2022). Evaluation of the possibility of applying the Clauses of the specification (ISO 45001: 2018) in a number of formations of the Ministry of Construction and Housing/comparative research. *Journal of Techniques*, *4*(4).. https://doi.org/10.51173/jt.v4i4.916

5- Jumaa, R. K. & Khaleel, A. S. (2022) "*Evaluation of the Application The Sixth Requirement of Integrated Project Management Practices According to ISO 21502: 2020 A Case Study in the Engineering Construction Department"*, Journal of Techniques, Vol. 4, No. 4, pp. 134-143. DOI: https://doi.org/10.51173/jt.v4i4.515

6- Krismastuti, F. S. H., & Habibie, M. H. (2022). Complying with the resource requirements of ISO/IEC 17025: 2017 in Indonesian calibration and testing laboratories: current challenges and future directions. *Accreditation and Quality Assurance*, *27*(6), 359-367.https://doi.org/10.1007/s00769-022-01523-w

7- Harzli, I. (2021). Application to risk management as part of the transition of the quality management system from ISO 17025 v2005 to ISO 17025 v2017: case of MULTILAB laboratory in Tunisia. *Journal of Business and Management Sciences*, *9*(3), 130-144.doi=10.12691/jbms-9-3-5

8- Orabi, Rudaina Sheikh (2021) "A study on the reality of laboratories in Syria according to the general standards ISO 17025:2017 for the efficiency of testing and calibration laboratories - a case study of the laboratories of the Faculty of Medicine at Al-Sham Private University" Master's thesis in Quality Management, Syrian Virtual University, Syria

9- Beckert, S. F. (2021). Customer requirement or appropriate calibration method? Which is more important?. *Measurement: Sensors*, *18*, 100318.. https://doi.org/10.1016/j.measen.2021.100318

10- Miguel , A. L. R., Moreiraa, R. P. L. & Oliveira, A. F. D (2021) "*ISO/IEC 17025: History And Introduction Of Concepts"*, Química Nova, Vol. 44, No. 6, p. 792-796, http://dx.doi.org/10.21577/0100-4042.20170726

11- Panhwar, A. I. J. A. Z., Naeem, M. A., HAQ, A. U., Zainulibad, S., Ahmed, M., & Haq, S. U. (2020), "Laboratory management system and competency of accredited laboratories". International Review of Basic and Applied Sciences, 8 (2), P. 9-13.https://doi.org/10.24941/ijcr.37844.01.2020

12- Al-Shuraiqi, Suhaila Salman (2019) "Obstacles to using the science laboratory from the point of view of science teachers for the upper basic stage in Qasabat Al-Mafraq," Journal of Educational and Psychological Sciences, Volume 3, Issue 29, pp. 72-86.https://doi.org/10.26389/AJSRP.S040319

13- Ahola, M. (2019), "Laboratory accreditation, ISO 17025 standard requirements for testing laboratories & passive base station antenna test procedure manual"",Master thesis, Oulu University of Applied Sciences Degree Programme, Information Technology, Finland

14- Putri, Z. T., Fahma, F., Sutopo, W., & Zakaria, R. (2019). A framework to measure readiness level of Laboratory for Implementing ISO/IEC 17025: a case study. In *IOP Conference Series: Materials Science and Engineering* (Vol. 495, No. 1, p. 012011). IOP Publishing. https://iopscience.iop.org/article/10.1088/1757-899X/495/1/012011

15- Aqidawati, E. F., Sutopo, W., & Zakaria, R. (2019). Model to measure the readiness of university testing laboratories to fulfill ISO/IEC 17025 requirements (a case study). *Journal of Open Innovation: Technology, Market, and Complexity*, *5*(1), 2.. DOI:10.3390/joitmc5010002

16- Al-mijrab, A. S. A., Elgharib, M. E., & Al-Griw, M. A. (2019). Critical success factors of ISO/IEC 17025 implementation within arabic countries: A case study of libyan research centres and laboratories (LRCL). *ST-6: TQ e-learning practices in industries*, (6), 6

17- Andargie,W. (2019) "*Challenges And Impact Of Iso/Iec17025 Accreditation; In Ethiopian Conformity Assessment And Ethiopian National Metrology Institute"* Doctoral dissertation, st. mary's University

18- Islek, D. S., & Yukseloglu, E. H. (2018). Accreditation of forensic science laboratories in Turkey in the scope of TS EN ISO/IEC 17025: 2017 standard. *Medicine Science*, *7*(4), 962-966. doi: 10.5455/medscience.2018.07.8885

19- Ghernaout, D., Aichouni, M., & Alghamdi, A. (2018). Overlapping ISO/IEC 17025: 2017 into big data: A review and perspectives. *International Journal of Science and Qualitative Analysis*, *4*(3), 83-92. http://www.sciencepublishinggroup.com/j/ijsqa

20- Anastasopoulos,G. (2017) "*The new ISO/IEC 17025: 2017",* CAL LAB the International Journal of Metrology, p. 30-5.. https://osmanvural.com/user_files/jul17_webdragged.pdf