Introduction of '5M1E' Mode of Quality Management in Chemical Analysis Laboratory of Special Equipment

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ABSTRACT
In the special equipment industry, the accurate and normal operation of chemical analysis laboratory is an important basic guarantee to ensure the safe operation of special equipment media, materials and special equipment. This paper introduces the six links of man, machine, material, method, environment and measurement in the quality management of special equipment chemical analysis laboratory, and forms the "5M1E" quality management model. It is hoped that through safe, accurate, effective and standardized management and operation, it will provide a strong basic guarantee for the safe operation of special equipment and people's life safety in terms of basic chemical analysis.

Keywords: *5M1E, quality management, chemical analysis laboratory, special equipment*

1.INTRODUCTION

Quality management system refers to the management system that commands and controls the organization in terms of quality. Quality management system is a systematic quality management mode established within the organization and necessary to achieve quality objectives. It is a strategic decision of the organization. The operation of laboratory quality management system will directly affect or even determine the final effect of inspection and testing. Therefore, we should pay attention to the quality management of the laboratory and ensure the smooth operation of the system, so as to meet the needs of China for the development of high quality and high precision.

The quality management system of the laboratory refers to a relatively perfect quality inspection standard formed in various laboratories with products and customers as the object. In this standard system, it is necessary to cover all the quality management, technical management and administrative management activities of the laboratory and the whole process of inspection work, so as to establish a mature quality management system, Is to better ensure the accuracy and reliability of the test results; So as to provide customers with more efficient services and products and improve consumer satisfaction.

In the quality management system, five important factors are Man, Machine, Material, Method and Environment. According to the special nature of the chemical laboratory in the special equipment industry, we combined the most important part of measurement to form the 5M1E management model. The six analyses of man, machine, material, method, environment and measurement are not independent, but influence each other. As long as one of the six elements' changes, it must be recalculated. In the internal quality control of the laboratory, the staff should control the stability of the data analysis quality of the laboratory, and be able to judge and correct abnormal phenomena in time[1].The establishment of a quality management system can standardize various links or processes in laboratory work, and supervise quality problems in various processes according to perfect quality management control standards to ensure that laboratory work can be governed by rules and regulations [2].

2.MAN

In practical work, man, machine, material, method, environment and measurement belong to six elements, which are equally important and indispensable. But among the many factors, the human factor is the most critical and the most direct, and directly determines the effectiveness of the work [3]. Man is the most important

part of the quality system, which including experimental operators, project leaders, chief engineers and system managers.

Quality management is people-oriented. Only by continuously improving the quality of people can we continuously improve the physical quality of activity or process quality, product quality, organizational quality, system quality and their combination.

People make the best use of their talents and are good at employing people. The key consideration is the experimental staff's awareness of quality, technical proficiency, physical condition, etc. The main reasons for operating errors are generally controlled by the experimental personnel: poor quality awareness, carelessness during experiments, and non-compliance with experimental procedures, low experimental skills, unskilled skills, and boredom due to simple and repetitive work. First of all, the ability standard requirements of personnel should be clearly defined. When setting up internal organizations and positions, according to the quality management system, it is necessary to clarify their own job standards, job authority requirements, and job conditions for each other. The abilities of all personnel must meet the Standard, to avoid the problem of specialization of personnel [4].In response to the problems that may arise from human factors, our control measures include: strengthening the quality HSE awareness education of "quality first, safety first", and establishing and improving the quality HSE management system; Write clear and detailed operating procedures, strengthen professional training, and work with certificates; strengthen inspection work and appropriately increase the frequency of inspections; eliminate the boredom of experimenters by adjusting personnel between inspection projects and enriching work experience. Various proficiency testing, experimental comparison and internal quality appraisal activities within the department promote self-improvement capabilities.

3.MACHINE

The management of machine is divided into three aspects: use, calibration, and maintenance.

Factors to consider of machine selection include:

1. Whether the machine meets the required standard methods.

2. Whether the personnel operating the machine have relevant qualifications or have received relevant training.

3. Whether the personnel operate the machine correctly.

4. Whether the laboratory conditions meet the environment in which the machine needs to be stored.

5. Whether the machine needs to be stored.

6. Whether the normal operation of the machine is correct.

7. Whether the daily maintenance and repair of the machine is smooth.

8. Whether the supporting facilities for the machine meet the requirements.

For the equipment with quantity value requirements, the quantity value traceability shall be carried out according to the specified cycle, and the effectiveness of traceability is not available. The control measures adopted include scheduled measurement, self-calibration, regular inspection of key accuracy and performance items of machines (calibration curve, recovery rate, standard sample), and key control of machine at key points in the quality of inspection results; strengthen machine maintenance and maintenance (regular and planned); use automatic display or automatic recording devices as much as possible to minimize the operating errors of the experimenters.

Who is responsible for the calibration work, who is responsible for determining which machine needs to be calibrated, who is responsible for submitting machine for inspection, and how these machines are achieved [5].

4.MATERIAL

Material management includes inventory management, material handling, and material visual management. It involves that the quality of materials meets the requirements, the purchase time meets the use, the purchase process meets the regulations, and the recycling and processing are scientific and environmentally friendly.

Clarify the reference materials and dosages used by the staff for testing, special personnel to make storage registration, do a good job in the verification of reference materials, ensure that the reference materials are safe and effective, and do not affect the test results.

Objectively speaking, there are many unsafe factors in the laboratory. Once all kinds of experimental materials are used improperly, they may cause irreparable serious consequences. Many experimental materials are corrosive, flammable, explosive and toxic. Therefore, the laboratory must improve its crisis awareness and implement the work of laboratory safety and quality monitoring.

Classified exhaust reagent cabinet; constant temperature and humidity; indoor maintenance for 24h exhaust; set up gas monitoring probe; 24h monitoring; double lock for two people; Clearly specify quality requirements in relevant material procurement contracts, select suppliers reasonably, urge and help suppliers to do quality assurance work, be familiar with the

procurement process, and meet relevant procurement requirements.

In order to achieve the expected purpose of quality control, reference materials shall be selected according to the following conditions [6]:

1. The quantity value (or content level) of the reference material shall be similar to that of the measured material;

2. The matrix of the reference material shall be the same or similar to that of the tested object as far as possible;

3. The form of reference material (liquid, gaseous or solid) shall be the same as that of the tested material;

4. Reference materials shall be used within the validity period, and their preservation shall meet the specified storage conditions;

5. The uncertainty U_{RM} (including 95% probability) of the quality value of the standard substance is different from that of the tested substance：

$$\mathrm{URM} \leq \frac{1}{3}\mathrm{U}$$

5.METHOD

Measurement standard is the main resource for the laboratory to carry out activities and the necessary condition for the implementation of laboratory calibration and testing.

The identification method involves: coal and coal products, industrial boiler water quality, thermal power generation unit and steam power equipment water vapor, boiler water treatment chemicals, ion exchange resin for boiler water treatment, organic heat carrier, environmental wastewater 8 test objects, 64 items /parameters, 126 standards.

When it comes to methods, the factors to be considered are: whether the relevant detection methods are suitable, whether the relevant laboratory personnel can see clearly, whether the standard methods adopted are currently valid, whether the personnel operations are carried out in the correct way, and whether the relevant methods are clear. Whether the qualifications of the inspectors meet the requirements of the method and regulations, whether the existing environment of the laboratory meets the requirements of the method, etc.

The control measures adopted include: ensuring that the instruments and equipment, supporting accessories, etc. meet the method requirements; strengthening technical and business training to make the experimenters familiar with the detection methods, instrument operation, instrument maintenance, and analysis of experimental results, etc.; standard method novelty checking (special personnel, regular) ; Combined with standard novelty search, actively formulate and revise work guidance documents, so as to take timely measures to adjust; combine data, sum up experience, provide a technical basis for the formulation and revision of standard methods, and promote method and technical progress.

6.ENVIRONMENT

The environment generally refers to the temperature, humidity, noise interference, vibration, lighting, indoor purification and on-site pollution of the laboratory. In addition to ensuring the special requirements for environmental conditions, it is necessary to do a good job in on-site sorting, rectification and cleaning, vigorously improve civilized production, and create conditions for lasting and efficient inspection work. Workplace environment, control of dangerous goods, production environment.

The current situation of the laboratory environment: fresh air system - dust removal, temperature adjustment, humidification - constant temperature and humidity; fume hood, exhaust hood, ground exhaust - 6~12 times/h; hazardous chemicals reagent room, precursor reagents room, gas cylinder room (semi-automatic switching valve), sample room; test bench circuit function column, municipal water and pure water;

Factors that need to be considered when it comes to environmental analysis: whether the experimental environment has undergone environmental changes on the time axis; whether light, temperature, humidity, altitude, pollution and other factors have been considered comprehensively, whether the laboratory environment is safe, and the changes in the environment Whether it is caused by human beings, and whether some small environments and large bad environments can be compatible.

In the work of the laboratory, many experimental operations need to be carried out in harsh environments such as high temperature, high pressure, microwave and radiation. Therefore, the laboratory can carry out safety drills purposefully, exercise the emergency response ability of employees to deal with accidents, and ensure the safety of employees and the public property of the unit to the greatest extent.

The work and storage of measurement standards need to be guaranteed by necessary facilities and monitoring means, such as air conditioner, humidifier, dehumidifier, thermometer and hygrometer, grounding, electrostatic removal, lightning protection, ventilation and other equipment and facilities, so as to ensure the correct implementation of laboratory activities. The areas where the laboratory carries out testing activities shall be reasonably divided, and the testing area shall be isolated from the office area as far as possible to control

the areas where personnel enter or may affect the quality of laboratory activities[7].

7.MEASUREMENT

Measurement mainly refers to measurement tools, measurement methods, and trained and authorized measurement personnel. Use the designated and regularly inspected measurement tools, and unify the standardized measurement methods to ensure that the data errors measured by the same measurement point, the same measurement tool, and different measurement personnel meet the standard requirements. During the experiment, the detected data should be recorded.

Designate the responsible person, use the specified measuring tools and instruments at the specified measuring point; use the correct measuring method; measure according to a certain frequency; and have standardized records.

a. Determine the measurement task and the required accuracy, and select the testing instrument/equipment that has the required accuracy and precision capabilities.

b. Periodically confirm, calibrate and adjust all measuring and test equipment.

c. Specify the necessary calibration procedures. Its content includes equipment type, serial number, location, calibration cycle, calibration method, acceptance method, acceptance criteria, and measures to be taken when problems occur.

d. Save the calibration record.

e. When it is found that the measurement and test equipment is not in a calibrated state, immediately evaluate the validity of the previous measurement and test results, and record it in the relevant documents.

8.CONCLUSION

Our society is developing rapidly, science and technology are developing rapidly, and the market competition is becoming more and more fiercer. In order to improve the market competitiveness and provide strong technical support for the government and the industry, the laboratory must improve its management ability and meet the needs of the society with high-quality services and satisfactory products. The "product" of the laboratory is the data and results of verification, calibration and testing. It is a comprehensive embodiment of the management level of the laboratory.

This paper introduces the six links of man, machine, material, method, environment and measurement in the quality management of special equipment chemical analysis laboratory, and forms the "5M1E" quality management model. It is hoped that through safe, accurate, effective and standardized management and operation, it will provide a strong basic guarantee for the safe operation of special equipment and people's life safety in terms of basic chemical analysis.

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