

**INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

HJ 840-2017

**Technical guidelines for environmental impact assessment
Analytical methods for micro-quantity of uranium in
environmental samples**

环境样品中微量铀的分析方法
(English Translation)

Issued on: July 7, 2017

Implemented on: August 1, 2017

Issued by: Ministry of Ecology and Environment

Table of Contents

Foreword

1 Scope of application

2 Normative reference documents

3 Laser fluorescence method

3.1 Principle of the method

3.2 Reagents

3.4 Sample collection, transportation, preservation and pretreatment

Foreword

In order to implement the Environmental Protection Law of the People's Republic of China and the Law of the People's Republic of China on the Prevention and Control of Radioactive Pollution, Quantity management, standardize environmental monitoring methods, the development of this standard.

This standard specifies the analytical methods for trace uranium in environmental water samples, air, biological and soil samples.

The technical content of this standard to GB 6768-86 "trace uranium analysis method", GB 11223.1-89 "biological samples of gray uranium Determination of uranium in biological samples by laser liquid fluorescence method ", GB 11220.1-89" GB 11223.2-89 " "Determination of uranium in soil CL-5209 Extraction resin Separation of 2-(5-bromo-2-pyridylazo) -5-diethylaminophenol spectrophotometry" GB 12378-90 "Methods for Analysis of Trace Uranium in the Air TBP Extraction Fluorescence Method", GB 12377-90 "Analytical side of trace uranium in the air Method of laser fluorescence "integration. The integration process with reference to GB 14883.7-2016 "food safety national standard food radiation Determination of natural thorium and uranium in substances ", EJ/T 550-2000" Determination of uranium in soils, rocks and other samples "and" HJ " 168-2010 "Environmental Monitoring and Analysis Methods Standardization Technical Guidelines" and other information.

"Trace uranium analysis method" (GB 6768-86) was first released in 1986, the original standard drafting unit for the state-owned 504 factory and the third research institute of the Ministry of Nuclear Industry; "Determination of uranium in biological samples of solid fluorescence method" (GB 11223.1-89) first published in 1989 Year, the original standard drafting unit for the Ministry of Nuclear Industry State-owned 814 factory; "biological samples of uranium determination laser liquid fluorescence method" (GB 11223.2-89) was

first released in 1989, the original standard drafting unit for the Ministry of Nuclear Industry State-owned 814 factory; "soil uranium determination Separation of 2- (5-bromo-2-pyridylazo) -5-diethylaminophenol spectrophotometry by CL-5209 extraction resin (GB 11220.1-89) Was released in 1989, the original standard drafting unit for the Ministry of Nuclear Industry Beijing Institute of the fifth; "analysis of trace uranium in the air TBP (GB 12378-90) and "Analytical Methods for Trace Uranium in the Air" (GB 12377-90) Quasi-first published in 1990, the original standard drafting unit for the Ministry of Nuclear Industry State-owned eight one two plants. This is the first revision. Revised main content.

- the integration of the above six scattered standards, merged into a standard;
- Determination of trace uranium in environmental water samples, air, biological and soil samples by laser fluorescence method.
- the addition of uranium in biological samples of the determination of uranium N-235 extraction - spectrophotometric method, and gives the uranium thorium combined analysis sequence;
- increased individual steps in the sample pretreatment and analysis process;
- Specification of part of the text and parameter units according to the current standard requirements.

Since the implementation of this standard, "trace uranium analysis method" (GB 6768-86), "Determination of uranium in soil CL-5209 Separation of 2- (5-bromo-2-pyridylazo) -5-diethylaminophenol spectrophotometric method (GB 11220.1-89), " (GB 11223.2-89), "Determination of uranium in bio-sample ash solid-state fluorescence method" (GB 11223.1-89), "Analytical Methods for Trace Uranium in the Air TBP Extraction Fluorescence" (GB 12378-90), " Method of laser fluorescence method "(GB 12377-90) abolished.

The appendix to this standard is an informative appendix.

This standard is proposed by the Safety Supervision Division of the Ministry of Environmental Protection.

This standard is organized by the Ministry of Environmental Protection Nuclear Safety Management Division, Science and Technology Standards Division.

The main drafting unit of this standard. Zhejiang Province, radiation environmental monitoring station, Qingdao Environmental Monitoring Center Station, Guangxi Radiation Environmental Supervision management station.

The Environmental Protection Department of this standard was approved on July 7, 2017.

This standard has been implemented since August 1, 2017.

This standard is explained by the Ministry of Environmental Protection.

Analysis of Trace Uranium in Environmental Samples

1 Scope of application

This standard specifies the analytical methods for trace uranium in environmental water samples, air, biological and soil samples.

This standard applies to environmental water samples, air, biological, soil samples of trace uranium analysis, also applies to the nuclear facilities camp Transport units, nuclear technology utilization units, uranium (thorium) mines and associated radioactive minerals development and utilization units of uranium pollution monitoring.

2 Normative reference documents

The contents of this standard refer to the terms of the following documents. For those who do not specify a date, the valid version applies to this standard.

GB 12997 water quality sampling program design technical specifications Technical Guidance for Water Quality Sampling Technical specification for preservation and management of sampled samples of water quality GB 12999 GB 12379 Environmental nuclear radiation monitoring regulations GB 14883.7 Determination of natural thorium and uranium in radioactive substances in foodstuffs Technical specification for radiation environmental monitoring of HJ/T 61 EJ/T 550 Determination of uranium in soils, rocks and other samples - Laser fluorescence method

3 Laser fluorescence method

This method is applicable to environmental water samples (including surface water, groundwater, pollution sources), air, biology, soil Analysis of trace uranium in samples.

The measurement range of uranium in environmental water, air, biology and soil samples by laser fluorescence method was $2.0 \times 10^{-8} \sim 2.0 \times 10^{-5}$ g/L (water sample), 2.0×10^{-11} to 2.0×10^{-8} g/m³ (air sampling volume of 10 m³), $1.0 \times 10^{-8} \sim 1.0 \times 10^{-5}$ g/g ash (when the amount of silica was 0.05 g) and 1.0×10^{-7} to 1.0×10^{-4} g/g (soil sample amount 0.10 g).

3.1 Principle of the method

The uranium enrichment enhancer added to the liquid sample forms a stable complex with the uranyl ions in the sample. In the UV pulse Light intensity can be excited to produce fluorescence, and uranium content within a certain range, the fluorescence intensity and uranium content is proportional to, by measuring the fluorescence intensity, the calculated uranium content was calculated.

3.2 Reagents

2 Unless otherwise stated, analytical pure chemical reagents conforming to national standards are used for the analysis, and the test water is freshly prepared.

Ionized water or distilled water. The acid used in the absence of specified concentration refers to the analysis of pure acid. Nitric acid acidification is pH 2 nitrate Acid solution. When the reagent content is to be indicated, the following method is shown.

When the concentration of the solution is expressed as the mass concentration of the substance, the unit is in moles per liter (mol/L), and the sign of the quantity is c [for example, c (G/L), micrograms per milliliter ($\mu\text{g/mL}$) when the concentration of the solution is expressed as the mass concentration, (ρ (U) = 10.0 $\mu\text{g/mL}$]; if the solution concentration is given by the mass fraction, the sign is omega such as omega (NaCl) = 10%, that 100 g of the solution containing 10 g of sodium chloride, that is, 10 g of sodium chloride dissolved in 90 g of water] the unit is dimensionless; if the solution concentration is given in volume fraction, the symbol of the amount is psi [for example, psi (HCl) = 5%], indicating 100 mL the solution contains 5 mL of concentrated hydrochloric acid, the unit dimensionless.

The reagents used in the trace uranium analysis method should be used for the determination of uranium content, uranium content higher than the level of the reagent can not Used for the experimental process.

3.2.1

hydrofluoric acid (HF). mass concentration $\geq 40\%$.

3.2.2

nitric acid (HNO_3). mass concentration of 65.0% ~ 68.0%.

3.2.3

Nitric acid solution. c (HNO_3) = 1 mol/L.

3.2.4

nitric acid solution. 1 1.

3.2.5

Nitric acid solution. 1 2.

3.2.6

Nitric acid acidified water. pH = 2.

3.2.7

perchloric acid (HClO_4). mass concentration of 70.0% ~ 72.0%.