



Monitoring of Ionizing Radiations facilities – Experience and challenge

Lebanese Atomic Energy Commission

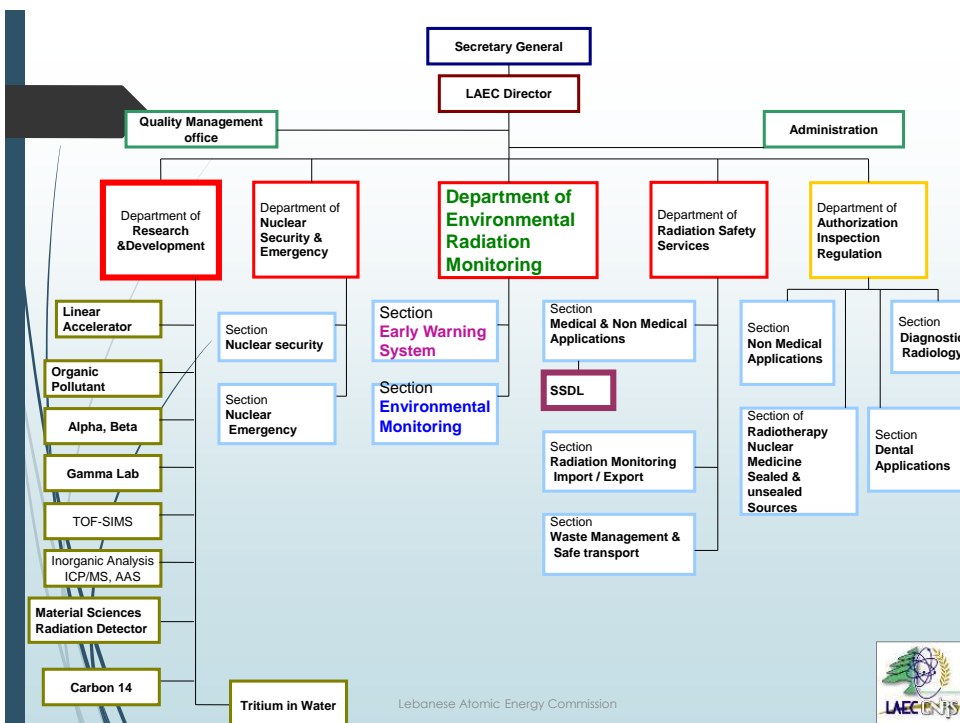
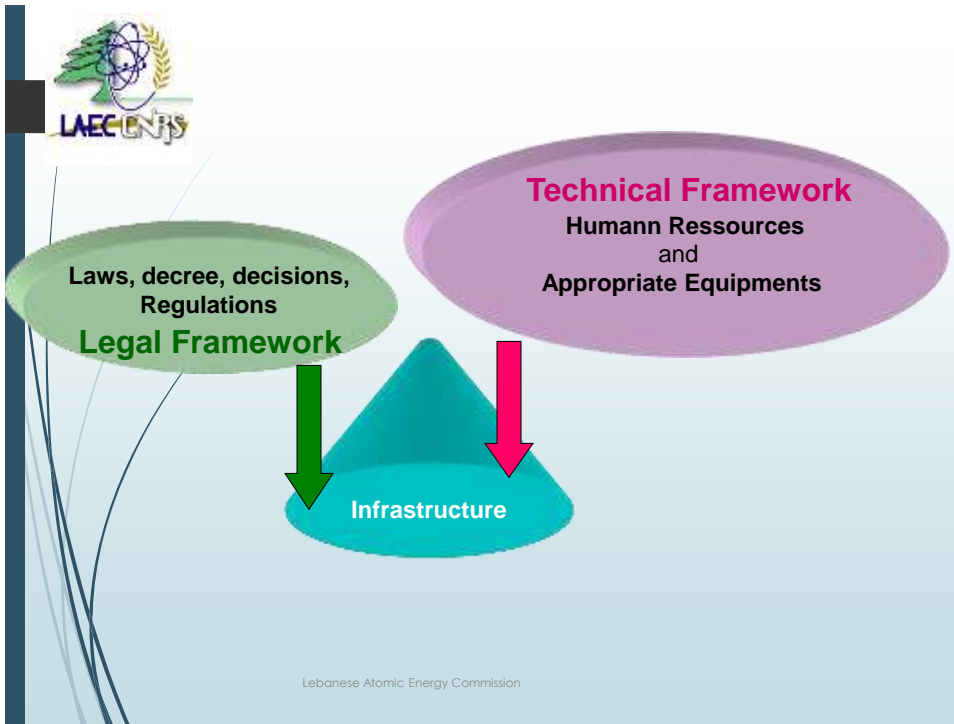


Lebanese Atomic Energy Commission

The LAEC was established in 1996 with the full support and assistance of the IAEA, having the mandate :

- ▶ Encourage and develop the peaceful use of Atomic Energy in the country and spread the Culture of Safety and Security of Radiation Sources
- ▶ Make applied research using nuclear techniques and technologies
- ▶ Establish the national infrastructure for radiation protection and prepare the necessary legislations for protecting the public, workers and environment against ionizing radiation (via the establishment of a comprehensive regulatory system)

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Gamma Spectroscopy Detection

- ▶ Research field
 - ▶ Detection of the activity of Gamma radiations in water, plants, soils and food products
- ▶ Instrument
 - ▶ High Purity Germanium HPGe Detector for radionuclides measurement (30%, 40% and 60% efficiency)
 - ▶ Sodium Iodide NaI Detector for screening of total gamma radiations



Need for Accreditation of Laboratories Activities - I

- ▶ **Radionuclides Spectroscopy Laboratories (ALMERA) :**
 - ▶ Recommendation from the IAEA (Regional TCP on QC/QA of nuclear analytical techniques) since 2003
 - ▶ The only laboratory offering such service in Lebanon (reference laboratory for the IAEA)
 - ▶ Being a reference laboratory for the Ministry of Agriculture (decision N°324/1/2007) for radiation monitoring of all imported powder milk and some other food stuff
 - ▶ Tool to insure the acceptability in abroad countries of analytical report related to testing of some Lebanese products entitled for exportation



Alpha & Beta Spectroscopy Laboratory

- Research field
 - Detection of activity of radionuclide emitting Alpha and Beta radiations in food products, water, and soil
 - U, Pl, Am
- Instruments:
 - Alpha Spectroscopy
 - Liquid Scintillation



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Ionic Accelerator Laboratory

- Research Field
 - **Archeology**: Authenticity and provenance (ceramic, glass ware, coins, paints).
 - **Environment** (aerosols, soils, sediments, food).
 - **Materials Sciences** (semi-conductors, supra-conductors, ...)
 - **Medicine and Biology** (tissues, organs, hair, nail, blood).
- Instruments: Electrostatic Accelerator (PIXE, PIGE, RBS, GRDA, NRA techniques)



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Inorganic Chemistry Laboratories

- ▶ Activity: Trace and Major elements in environmental and food matrices
- ▶ Instruments: Ion couple Plasma / Mass Spectrometry- CRI ICP/MS, Atomic Absorption Spectroscopy



Carbon 14 and Tritium in Water

- ▶ Research Field:
 - ▶ Hydrology and water treatment, pollution detection
 - ▶ Dating based on combustion of C14 (wood, paper, ...)



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Time Of Flight- Secondary Ion Mass Spectrometry Laboratory

- ▶ Research field:
 - ▶ Elemental and molecular composition) of the uppermost atomic or molecular layer of a solid (or frozen liquid) which may be a metal, plastic or organic.
- ▶ Instruments:
 - ▶ TOF-SIMS instrument with two sources:
 - Bi source for spectrometry and imaging
 - Ar source for organic profiling in 3D.
 - ▶ With different operational modes,
 - surface spectroscopy,
 - surface imaging,
 - depth profiling and
 - 3D analysis



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Organic Pollutants and Pesticides Analysis Laboratory

- ▶ Research field:
 - ▶ Analysis of various organic pollutants (pesticides, PAH, PCB's, veterinary drugs,...) in environmental and food matrices
 - ▶ Development of new chromatographic separation methods, semi- volatile, Volatiles and organic pollutants
- ▶ Instruments:
 - GC/MS,
 - GC-ECD,
 - GC-NPD,
 - GC-FID,
 - HPLC,
 - LC/MS



Early Warning System

- ▶ Objective: monitoring dose rate in air ion continuous basis
- ▶ 20 monitoring sites distributed all over the Lebanese territory
- ▶ One central site at LAEC – Beirut; data analysis and archiving

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LAEC Activities (Radioprotection)- I

Authorization – Inspection – Regulation

- ▶ Issuing of national regulation relevant to the use of ionizing radiations in different practices
- ▶ Scientific and Technical evaluation for request of using ionizing radiations (import, export, uses,...)
- ▶ Inspection & control for the implementation of Radiation Protection guidelines in practices (BSS – IAEA)
- ▶ Establishment of National Register for the radioactive sources movement

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LAEC Activities (Radioprotection)- II

Radiation Safety Control

- ▶ Regular control of radiation exposure for workers in controlled area (TLD) ~3200 workers, >200 institutes
- ▶ Quality Control for equipments emitting of ionizing radiations used in medical, industrial and scientific field
- ▶ Workplace monitoring

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Technical and Scientific Framework - II

Radiation Protection

1. TLD (Thermo Luminescent Dosimetry) for monitoring of **Personal Radiation Exposure**
 - 250 medical & industrial institutes (hospital private clinics, industries, research centers..)
 - > 3200 employee
- ▶ Laboratory under accreditation process





Technical and Scientific Framework - II

Radiation Protection

2. SSDL (Secondary Standard Dosimetry Lab). This laboratory is assigned under the **Lebanese Metrology Committee**

Activity: Calibration of Radiation Detectors used to control radiation leakage



Technical and Scientific Framework - II

Radiation Protection

3. A variety of handheld radiation detectors, dose rate measurement, etc...

4. Radiation monitoring labs



LAEC Activities (Radioprotection) - III

Protection against Ionizing Radiation



- Control of radioactivity level in exported food products and some imported food products
- Control of radioactivity (borders - ports) of imported construction metals and exported Scrap
- Assure the safety and security of transport of radioactive sources
- Help users in planning for radioactive waste management



LAEC Activities (Radioprotection) - IV

Control of radioactivity level in the Environment

- Regular analysis of food products water, soil, air, grass...
- Establishment of the Radioactivity Map Level in Lebanon (Soil – Background)
- Establishment of the Early Warning System for early detection of any radioactive contamination (accident, malpractice)



LAEC Activities (Radioprotection) - V

Nuclear Security and Emergency

- Combating the Illicit Trafficking of Radioactive Sources (control on check points – CUSTOMS/LAEC). RPM projects
- Physical Protection of Category I-II sources (on site if used – re-exportation of disused)
- Providing Technical Support in emergency cases (Nuclear) and accident (local contamination)



Participation within MAPEP scheme

- Added values for our technical performance
- Opportunity to detect analytical shortage
- Variety of samples and analytes (radionuclide and trace elements)

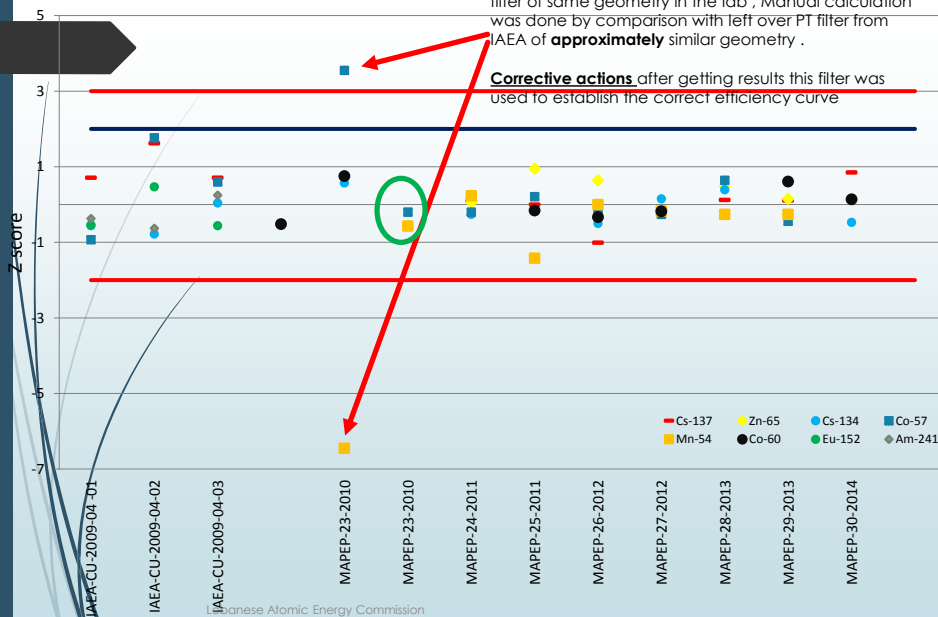
Gamma Spectroscopy lab performance through Z-score evaluation

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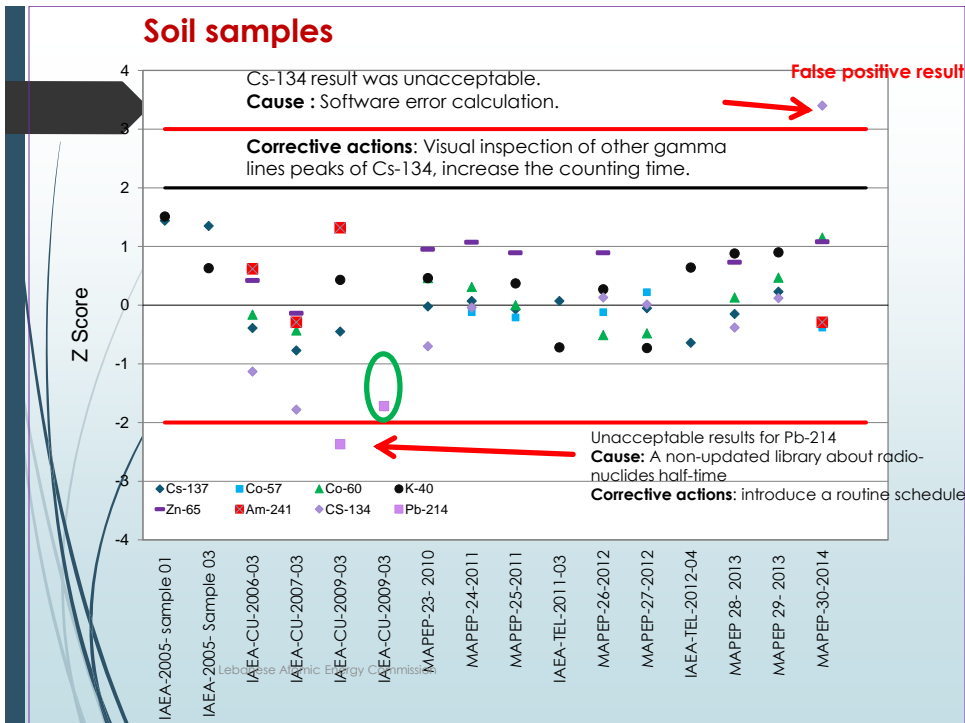
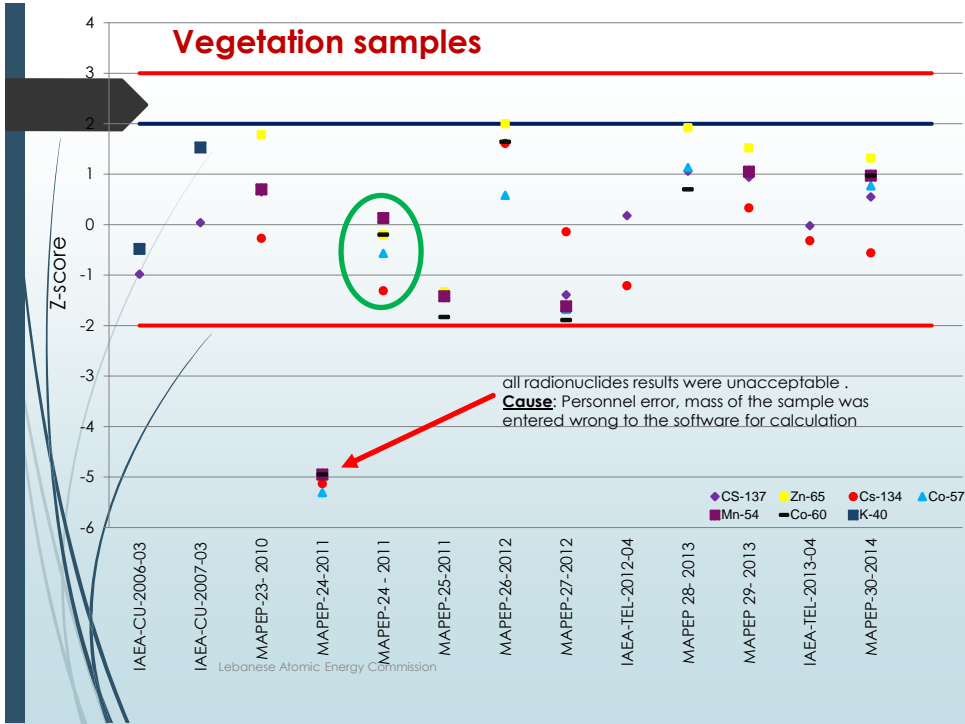
Air filter samples

Cause: the efficiency curve for air filters was not established yet due to non availability of reference air filter of same geometry in the lab , Manual calculation was done by comparison with left over PT filter from IAEA of **approximately** similar geometry .

Corrective actions after getting results this filter was used to establish the correct efficiency curve



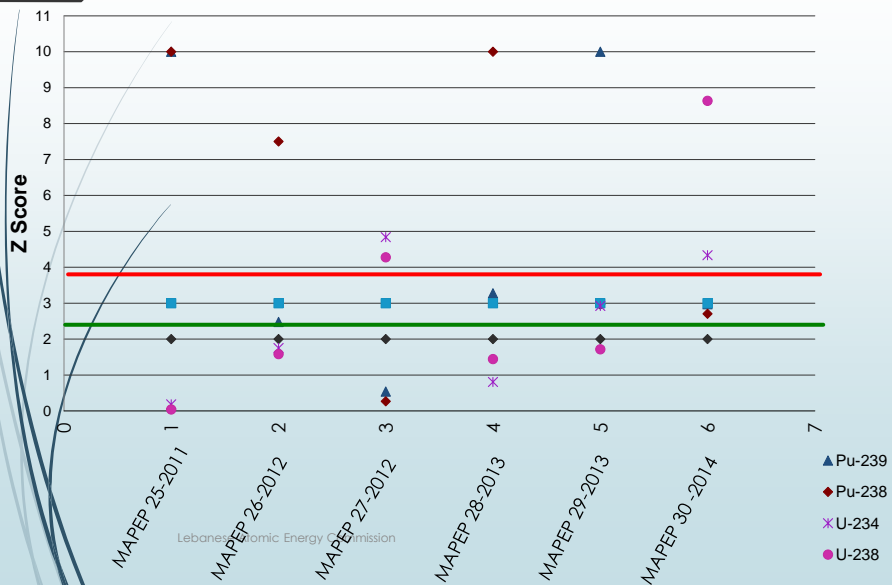
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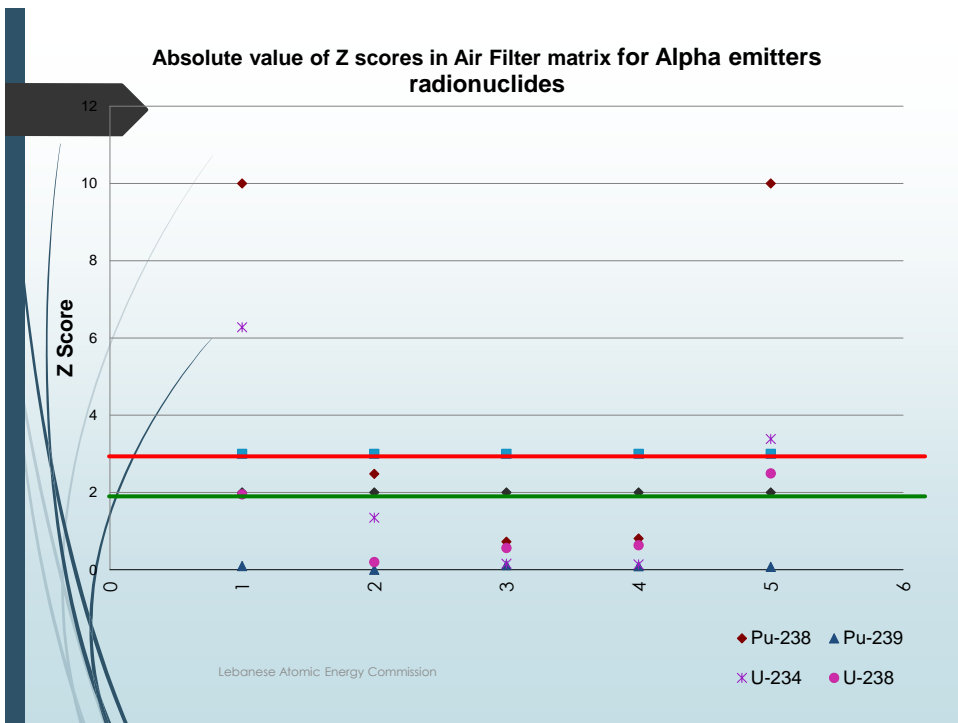
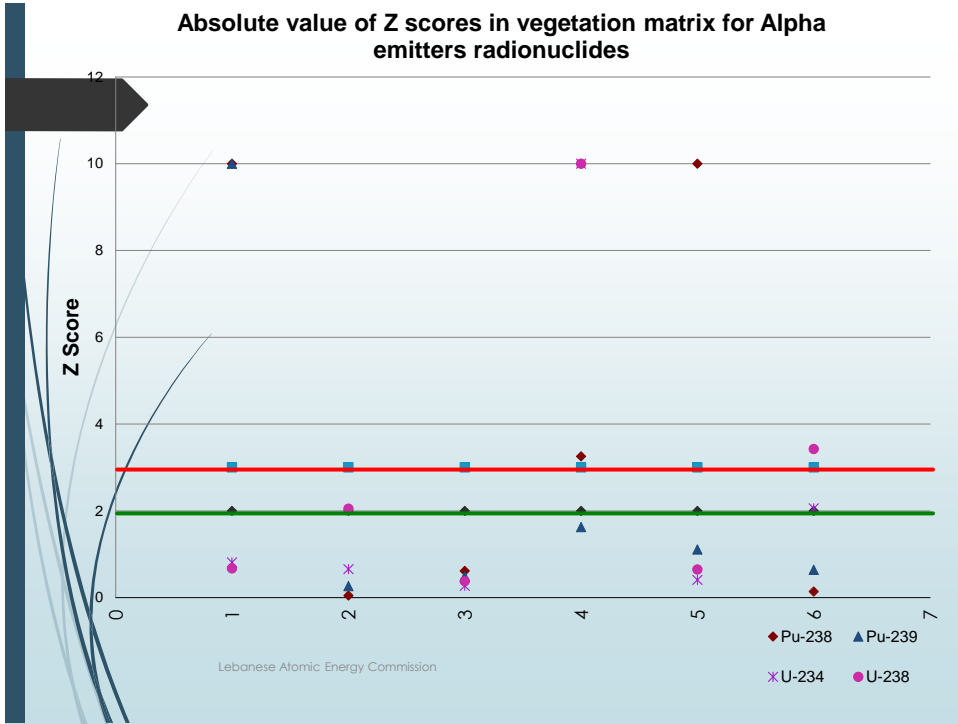


Alpha scintillation laboratory performance through Z-score evaluation

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Absolute value of Z scores in soil matrix for Alpha emitters radionuclides





Alpha scintillation

- Problem with sample digestion due to silica presence in soil sample (presence of interferences)
- Not enough air filter samples

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Challenges with Radiation Monitoring Facilities

- Availability of local suppliers for standards and equipments
 - Long bureaucratic process for importing approval
- Development of technical procedures for optimizing measurement conditions
- Proof of credibility of measurement through implementing "Quality Management System"

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**Thank you for your
attention**

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