Station for measuring environmental radioactivity aerosol in real time spectrometry analysis with full control and remote maintenance

Real-time measurement

Automated process

Spectrum reading

Spectrometric analysis

Report

Summary

Radioisotope identification

http://www.raditelserveis.com
The project

The Technical University of Catalonia (UPC) and RADITEL have jointly developed a high technology station to measure radioactivity in the air. The technology of the station allows full remote control, even for technical maintenance settings, minimizing the presentational assistance. The Advanced Radiological Monitoring Network of Catalonia, centralized in Barcelona, has at present 5 of such stations with four years of operating experience.

The scientific part of this station, such as the Spectrum Analysis System, has been developed by the NERG (Nuclear Engineering Research Group) of the UPC, Department of Physics and Nuclear Engineering. RADITEL has developed the mechanical challenges and the software for the control and telecommunication system.

Operation

Air samples are taken by a programmable flow pump. These samples go to a filter paper. As the air passes through it, the paper filter retains aerosols. A lanthanum bromide scintillator probe detects the gamma radiation emitted by the deposited aerosols, and the associated instrumentation generates an energy spectrum of gamma radiation. This spectrum is real-time displayed on the computer screen. After finishing the analysis, the report is stored in the computer, and later transmitted to the remote control center at the headquarters of the customer.

The paper filter remains stationary during the integration period. Once this period has finished, the paper filter coil automatically advances and leaves a clean filter ready for the next integration.

There is a primary integration time period up to 24 hours. In order to detect specials events, additional integrations can be performed, with times from 10 to 60 minutes. Both integration times and the rest of the station settings are totally adjustable by the customer.

A set of sensors continuously overview the station operation and report in real-time. This ensures that sampling is performed whenever the station operating on the appropriate parameter range. Even in case of power surges at the station have a resettable circuit breaker, disconnect it from the electrical system and automatically reconnected when it detects the correct power quality.
**Automation**

The station is integrated into a system of networked computer automation of the whole process, since the integration starts at the field station until the report is printed spectrometric analysis, keeping all results in a database.

The station is field installed by performing a real-time measurement and after each integration, the computer file generated by the operating status of the station are transferred to the control center. In this center there is a software that automatically analyzes the spectrum to the method of gamma spectrometry. All results are stored in a database and a report is printed. If the event of a radiological incident is detected, it is reported by automatic emailing to all supervisors of radiation network. The same applies to the analysis file of the operating status of the station. If an abnormality is detected as it could be a torn paper, a reduced flow sucked into the pump, a temperature rise above the threshold of work, etc..., is notified by automatic emailing to all technical maintenance key network of radiation, which can be adjust remotely.

This automation allows customer a complete and real-time control, both of radiation measured as the operation of the station, even with a high number of stations installed.

**Full remote control for adjustment and maintenance**

Many stations as a network of radiological control booths are usually located in the field or in places difficult to access. The system is designed for technical maintenance, monitoring and adjustment of the station can be performed remotely from the control center.

This system allows the remote control station tasks:
- setting the suction flow of air to be sampled
- channel setting of the intrinsic peak
- setting the width of the intrinsic peak
- setting the start and duration of periods of integration
- setting the high voltage detector
- update of the control program
- PLC firmware update

The station is equipped with a communication system that allows the transmission of audio and video between the room where the station is located and the control center, by and ADSL line.

It can be carried out even calibration station with the unique presence of a person with the station, not necessarily technically qualified, and following technical instructions from the control center. This person just follow the technical instructions, as placing and removing radioactive sources certified station. The rest of the procedure is undertaken by qualified technician remotely from the control center.
Features

General

- Continuous measurement of particle deposition in a paper filter fiberglass
- Paper filter remains fixed during the measurement. Auto scroll to the next integration
- Analysis of gamma spectra. The spectrum analysis system has been specially developed for the station.
- Easily replaceable for maintenance modular design, and technology upgrade
- Integrated in an industrial rack 600 mm x 600 mm x 1700 mm
- Approximate weight: 250 kg

Instrumentation

- LaBr3 2"x2" scintillation
- Spectrum stabilization without external radioactive source
- Lead shielding of 5 cm thick, optimized with layers to reduce the X-ray background
- Adjustable vacuum flow sampling up to 12 m3/h
- Compact instrumentation for detecting radiation
- Detection limits for 24 h: Cs-137 <0.02 Bq/m3; Co-60 <0.03 Bq/m3

Spectrum analysis system: "pGamma"

- Fully developed by the research group NERG (Nuclear Engineering Group) of the UPC
- Includes libraries with all natural and artificial isotopes of interest
- Optimized for the analysis of the expected or possible aerosols in the environment
- Identify the gamma emitters present on the spectrum
- Determine the activity concentration of each emitter identified
- Generates different kind of alarms, depending on the values read
- Results in 24/12 hours, hourly partial integration with alarm when a transient is detected

Monitoring and control

- Mechanical and electronic control with sensors in real-time by PLC and data acquisition module
- 15 "screen to display the local operation and maintenance
- Evacuation thermostatically controlled heat
- Detection of line pressure airflow for leakage control
- Alarm when the paper coil is broken and indicator of the paper coil status
- Temperature sensors at various points of the monitor
- Operating parameters defined in a configuration file
- System network connection for remote and non-contact settings
- Protection against power system events with a differential protection device with automatic reset

Automation

- Control system of the radiological surveillance fully automated, with this sequence:
  - scheduled connection to the computer
  - reading of the spectra generated and the file where the analog values of the monitor are stored
  - processing of the spectra with the spectrometric analysis system "pGamma"
  - storing the results of the analysis in a database
  - generation of reports with printer output
  - automated email warnings for any monitor malfunction.