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COMPREHENSIVE INDUSTRIAL ECOLOGICAL ENVIRONMENT MONITORING INFORMATION SYSTEM

The problems of the comprehensive environment protection, efficient and protective natural resources using is the one of the most actual problems for any country in the modern period of the human development. According the present Russian Federation legislation of the environment protection the production activity influenced on the natural environment must be supplied be the ecological monitoring and control. It means the organization of the system supervision of the human influence resources, providing the activity for reducing the risk of pollution by the production.

Environment monitoring is a complex of the activities for supervision of the ecological balance range around the industrial production and for the pollution level determination in the case of any breach. Monitoring provides the permanent supervision and the present assessment of biosphere or its elements condition and the possible change prediction. For the adequate forecast development it is impossible to know the environment change consistency under different factors influence. It is impossible to realize so complicated multi-criteria interaction without using of the modern environment monitoring information systems.

Automation environment monitoring and control system (AEMCS) must combine the function of the automation measurement for the environment conditions main parameters in the certain area, and the functions of collection, transferring, processing, storage and delivering to users initial as well as processed data.

AEMCS keep the environment monitoring static data and in the case of critical situation AEMCS can alarm the coordinating enterprise services, the control organizations and certain national emergency services if it is necessary. In some cases AEMCS provides the activity to stop the deleterious effect for environment by involving the production processes via Industrial Automation and MES.

The Automation Environment Monitoring process includes such stages as:

1. Supervision organization, collection and initial processing of the environment condition analyses samples and the main production process parameters.
2. System analyses of the consolidated data arrays
3. Analytics, report generation
4. Decision making support taking into account possible ecological risk

The base of AEMSC is an information block which combines the monitoring results storage, database, measurement and computer devices, and the telecommunication systems and equipment as well.

Automation system consists of the components:

- Hard- and software complex, the lower level automation devices (sensors, stations, supervision points)
- Connection devices for data receiving, processing and transferring
- equipment and software of information analytic centre
- LIMS (Laboratory Information Management Systems) software
- Geo - information analytic system

The several variants of the environment monitoring system implementation are possible, including:

- Environment and technological monitoring data management complex, stationary environment monitoring posts
 - Mobile laboratories
 - Air-monitoring of the area environment conditions
- Let's see the some of them more detailed

Environment and technological monitoring data management complex.

Environment and technological monitoring data management complex is a module system for environment and technological monitoring data collection, storage, processing and visualization.

System characteristics:

- The possibility of the implementation for any scale enterprises
- Continuous monitoring of any parameters quantity for one station executing
- Automation control of the regulations and range values predefined by the control organization, providing the journal of these events
- Continuous monitoring of the pollution and remote transfer of collected data to the certain area state control organization execution
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Environment monitoring stationary posts.

Environment monitoring stationary post is a automation system for the solving the task of continuous air quality monitoring at the production area or any region

Stationary posts are equipped by gas-sensors, air selection and preparation, dust counter, meteorological sensors and other necessary devices. The quantity of the installing sensors is determined by the list of the parameters to control. The posts have the own life support system, fire- and unauthorized access alarm, computer systems for data initial collection and processing, and automation start in case of the electrical supply interruption. The system provides the sure gas –concentration determination for any work conditions. The resource of the system autonomous work without service maintenance is several months.

Due to this kind of posts installation it is possible to execute:

- 24 hours automation measurement of meteorological parameters and the concentration of polluting components in an atmosphere;
- Automation transfer of the measurement results
- Real-time ecological condition estimation for certain areas
- Real-time pollution dynamic prediction for certain areas
- Pollution dynamic prediction depending of the meteorological parameters
- Atmosphere pollution resources definition
- Ecological data archiving

Mobile laboratories.

Mobile laboratories are mounted on the base of cars and trucks. The application of this solution is effective to cover large areas

Mobile posts provide measurement and data collection in real time. The received results can be transferring to the information analytical centre by telephone or radio – communications

LIMS

AEMSC's core is the data storage and the knowledge base, normally it consists of three connected parts: conceptual (model of the subject researches and observation), factual (including databases) and algorithmic (specified software). The databases provide the storage of not only continuous monitoring data, but the necessary data for imitating statistic modules calculations as well

As AEMSC's core the software complex developed based on LIMS (Laboratory Information Management System) is used as a rule.

LIMS are used to manage the samples, instruments, users, standards/lab materials for each step of analytical process and many other laboratory function execution. It makes possible to automate the entire research process – from the initial materials preparation till the processing of results which are centrally archived in the data storage system.

The modern LIMS have a wide complex of the functionality which covers all the sides of the ecological laboratories activities:

- the test execution scheduling, the analytical control scheduling covering finalized tasks and the research process;
- the preparation operations control (for example, titres, calibration data);
- sample life cycle control;
- instruments management;
- analyses results registration, including automatically – directly from instruments
- the calculation of the results and the estimation of standard documentation compliance
- work assignment for the laboratory personnel
- reagents and standards management
- the authorization of the personnel and instrument control
- the quality certificates generation
- laboratory reports generation
- the confirmation of the monitoring results reliability and accuracy (regarding ISO

5725)

LIMS make possible to register final result received by calculation as well as initial data from instruments.

The final results are calculated by LIMS and managed by special algorithms for the normative documents compliance (ISO 5725, ISO 17025, RMG 61-2003, RMG 76-2004).

Particularly LIMS manage the accuracy of the measurement results automatically during the analyses tests executing, due to that the possibility of the results changes in LIMS is drastically reduced.

The system functionality is realized as modules. The part of the modules are included to the system core, another part is included to the system as additional. The system provides the possibility to make the typical laboratory functions automatically, such as

- sample login and registration;
- test assignment
- tasks assignment for different laboratories departments, instrument and personnel;
- tests execution
- the estimation of the compliance the results and the normative and standard documents requirements
- reports generation and many other tasks

All the system setting such as information elements choice, the sequence of the monitored elements determination, the screen forms choice, are determined by using the records of the reference library of LIMS database and it makes possible many ranges of setting and configuration providing the readiness of the product for adaptation in a wide range of functional implementation.

Full – functional LIMS consists of more than 200 tables in a database. For the goals of an environment monitoring LIMS are equipped with the interfaces to certain laboratory devices and information monitoring system software.

Information analytical centre.

Information analytical centre is intended to collect and keep the information of environment conditions and to visualize the received data. Also an information analytical centre contains the functions of decision making prediction and support for the ecological environment conditions optimization. These functions include:

- the coordination of creation and maintenance of natural resources and natural protection data base;
- the arrangement of information interaction and coordination of departmental centers activities related to transformation and exchanging of the control subject information
- the calculation of modeling tasks, mapping, the data processing for remote and laboratory probing;
- calculation process support

The monitoring system had a very simple algorithm of the structuring for database, final forms and reports, as well as functional data base organization. So, in the case of adding new information data base necessity this problem can be solved without the software developers involving and without additional software development. Besides that, a specialist can get the answers for non-standard questions directly at his workplace without the software developer action by visual form (business graphics, maps and so on), and not only in a text of numeral tables forms. It is achieved using the database performance as an information subject by object-oriented technology. The routine of the different types of information is provided for this situation. .

In the case of cartographical database management systems the cartographical characteristics and the algorithms of specific accessed are added into the information objects. Afterwards this information can be provided on maps. It is also possible to process the accessed depending on the area of an information belonging.

Geo-information analytical system.

Geo-informational analytical system provide the automated data collection for the environment monitoring of the object in the same database, and the processing and data analyses for monitoring, data visualization in the form of different maps, graphics and tables creation.

The main GIS functions:

- collection and receiving of graphic and factual data;
- quality control, downloading of the information to database
- efficient data transformation and calculation using flexible mechanism of access;
- efficient data performing for the requests in the tables- and GIS-forms;
- creation and formalization of cartographic materials for reporting;
- detailing and actualizing of the cartographic base;

- creating the visual forms – maps, legends, colors, signs, design, new form searching;
- algorithms and calculation mechanism development

Geo- data (geographic objects) are stored in GIS in geographic (or metric – for plans) coordinates. This data comes to the geographic base either by import form on of the change format or by maps vectoring. The object can be also created during the program running or one of the specific applications. In this case the topological connections between the geographic objects put to the base are supplied. The quality (accuracy) of the entered objects has determining value during many of hydro geological tasks solving and it always checked during the recording to the geographical base. The access system integrated with GIS database is using for monitoring data analyses. All the parts of GIS (terminological, reference, ecological database, cartographic base, etc) are created from the ready blocks, from project start and they are continuously detailing and upgrading during the running process. Thereby it is possible to process operative accesses to the system including spatial in any time.

Summary:

The environment protection management in industry requires exact and absolute compliance for the normative documentation and the rules of the technological and production processes. But this process development is impossible without exact, on time and adequate determination of the real conditions of environment.

Exactly biosphere components have anthropogenic influence of industry production, but from another side biosphere components are initial, basic parts of technological processes. For the level pollution of environment by the industry anthropogenic processes estimation the modern complex information monitoring systems are necessary to be implemented like a one of the high priority of the enterprises activities.