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A Comparative Study of Some Air Pollution Software

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Abstract

Nowadays, the pollution of the environment is one of the most important problems of the mankind. That is why the economic legislation of every country should contain policies about a pollution effect control. In this article, some air pollution monitoring software developed in different countries are described, the reasons why they have been created, their features and their facilities for the user.

Key words: *environment, air pollution, emission rate*

Introduction

Lately, there was an important increase of environmental reports about our activity negative impact on the ecosystems around us. A recent study shows that, if we continue to increase the production of CO₂ and other greenhouse gases, we will have a much higher concentration of pollutants by the year 2050.

Furthermore, another study presents that the average temperature of our planet will increase with 3°C until the end of the XXI century and the earth surface temperature will be 18°C, comparing to 15°C nowadays. Maybe it doesn't seem important, but we have to remind that the temperature had to increase with "only" 5°C in order to reach the end of the Ice Age [1].

So, this rapid change in earth temperature should make us understand that the humankind progress has become an activity with negative effects on the environment.

Being aware of this, the next step was to begin monitoring the way we destroy nature and to create systems to reduce environment pollution.

An important factor of this issue is industry. All three important elements of environment can be influenced by a single plant: *water*, by throwing toxic chemicals in the nearby lakes or rivers, *ground*, by permitting the solid waste to get in the surround soil, but especially the *air*, by eliminating in the atmosphere a lot of gases, as a result of the industrial process [2].

Depending on its products, a plant can have a huge emission of gases (CO, SO₂, SO₃, NO, NO₂, O₃), which can influence the basic composition of the air in a negative way and furthermore the people's health who live in this environment.

In this article, we will present some software which is used for the monitoring of the industrial air pollution. Some can be used even before the industrial process starts. They can predict if the air quality standards will be followed or not. Moreover, two products used during the process are described. They can measure and register the concentration of gases and create detailed reports about the plant's activity.

Brief Overview of Some Air Pollution Software

AUSTAL View, created for the German Federal Environmental Agency, uses a Lagrangian particle tracking air dispersion model. It also contains the facilities to create its own model that include details about the direction and intensity of the wind. It also can model the topographic zone as an important factor in the process [3].

ISC-AERMOD View, is also a powerful system for the air dispersion modelling. It was developed by the Environmental Protection Agency from the United States and it incorporates three popular models: ISCST3, AERMOD and ISC PRIME. Additional to these, ISC-AERMOD View has two more packages included:

- BPIP View, a graphical interface to facilitate the preparation of the input data;
- Rammet View, is used for processing National Weather Service (NWS) data and include them in the air quality model [4].

WinSCAN, is a software implemented by the Environment SA from France. It is distributed along with the instruments developed to register and analyze the concentration of the industrial process. The management of the data as well as the detailed reports are some of its important aspects [6].

TehnoINSTRUMENT from Romania has developed its own software to manage the collected data from the technological process. It can register simultaneous information from different sources and can create reports, plots or graphs as the result of the analysis [5].

Software Products Description

Having in mind the fact that we want to find out which software is more appropriate in a future study of the air pollution, we will try to compare their different features.

	Inputs			Outputs			
	Multiple sources	Changing parameters possibility	Input data validation	Reports	Frequency tables	Graphics	Exporting databases
AUSTAL View	-	✓	✓	-	✓	✓	-
ISC-AERMOD View	✓	✓	✓	-	-	✓	✓
WinSCAN	✓	✓	✓	✓	-	✓	✓
TehnoINSTRUMENT	✓	✓	✓	✓	-	✓	-

Table 1. The input and output characteristics of these software products

In Table 1 we can see some common characteristics: all four products give the possibility to change the input parameters list, to lose or to add new values, as well as the input data validation. This is mainly important because the user can focus on another task while the software is checking valid ranges for all entry fields.

WinSCAN, ISC-AERMOD as well as the TehnoINSTRUMENT software have incorporated another facility: the variable emission rate factors may be specified for a single source or for a group of sources, without affecting the process.

An important aspect in our description is the output and the different ways this can be done: reports, frequencies tables, graphics, plots or exporting the result database. All these four products can create output data graphics. This is the most intuitive way to understand the results. On one hand, using WinSCAN or TehnoINSTRUMENT one can have detailed reports on the process. On the other hand, if the emission rate frequencies are important AUSTAL View is the software you need.

The last column of this table shows that one has the possibility to export databases to another application like Access or Excel if you use WinSCAN or ISC-AERMOD.

	Modelling and simulation				Meteorological data
	Detailed contoured surfaces	Modelling the location of the source	Stack and buildings visualisation	3D visualisation	Wind speed and direction
AUSTAL View	✓	-	-	✓	✓
ISC-AERMOD View	✓	✓	✓	✓	✓
WinSCAN	-	-	-	-	-
TehnoINSTRUMENT	-	-	-	-	-

Table 2. Modelling capabilities and meteorological data process facility

AUSTAL View and ISC-AERMOD also have modelling options, from the possibility to use the mouse to graphically define the modelling area, the plant and the location of stacks to the capabilities to display model results as shaded cells or contours. Unlike WinSCAN and TehnoINSTRUMENT, AUSTAL View and ISC-AERMOD View provide dynamic 3D tools built right into their interface and the possibility to include in your model the meteorological data.

If the software includes all the features you need to complete your projects or if you have to purchase separate packages is another important aspect of the issue. Only ISC-AERMOD View is mentioned to include two support packages: BPIP –a model that calculates direction-specific building widths and building heights and Rammet View –a package for the process of pre-processing meteorological data. Support packages are not mentioned in the other three software description (Table 3).

	Support packages
AUSTAL View	-
ISC-AERMOD View	BPIP (EPA Building Profile Input Program) RAMMET View
WinSCAN	-
TehnoINSTRUMENT	-

Table 3. Support packages

Conclusion

Thus, in order to select a software product which is the most appropriate we have to decide when it is needed.

If we want a software to provide assistance so that the plant's activity should meet the air quality standards before the beginning of the process, then ISC-AERMOD View is suitable, because it has capabilities to model the geographic area, the buildings, the stacks in every detail, the meteorological data as well as the input parameters.

WinSCAN is recommended to register the values of the pollutants during and after the technological process and to establish if their concentrations are out of the normal ranges.

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Studiu Comparativ al unor Produse Software pentru Monitorizarea Poluării Aerului

Rezumat

Poluarea mediului este una din principalele probleme cu care se confruntă omenirea astăzi, de aceea monitorizarea efectelor poluării și încercarea diminuării acestora sunt niște aspecte importante de care ar trebui să se țină seama în legislația economică a unei țări. Acest articol descrie câteva produse software specializate în monitorizarea poluării aerului care au fost dezvoltate în diferite țări, câteva dintre caracteristicile și facilitățile oferite de acestea, cât și o analiză comparativă a lor.