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CMA4CH 2006 lectures

The quality of the measurements and the quality of life

Introduction

Society is daily influenced by analytical measurements on which legal, commercial and social decisions are based. The accuracy of a chemical measurement is fundamental, depending on its purpose, but it becomes still more important when analysis concerns the state of the environmental and human health. The measurements are a primary instrument of competitiveness as they guarantee the quality of a product or a service. An adequate metrological systems of calibration, certification and accreditation are the basic instruments for each industrialised country, which needs to be competitive in the international context. The existance of these systems could guarantee analytical results obtained in different laboratories so aiding mutual recognition from different countries and avoiding useless, repeated analysis.

While other EU countries have managed the improvement and the support of the measuring system by the creation of national institutes dedicated to the quality of such measurements, in Italy the situation is characterised by delay despite the high quality of the data. The data proposed by the experts demonstrate that a significant part of the performed analysis is not reliable leading to wrong decisions being made, this increasing economic damage (up to a €$billion$), $through\ damage\ to\ human$ health and the environment and to the competitiveness of products.

Industrialised countries generally spend about 6% of their gross internal balance on measurements and related operations. Much of these costs are wasted as they duplicate analysis already undertaken and relate to unbelievable analytical data. It was estimated each year that about 25 million of the measurements performed in the USA have produced unreliable results and have been repeated at an additional cost of €$5\ billion$. $Similarly,\ in\ Germany\ it\ was\ estimated\ that\ there$ was an added unnecessary cost of about €$12\ billion$. $In\ the\ approximately\ UK\ 30,000\ laboratories$ with 220,000 analysts on the staff perform one billion experiments, corresponding to 30 measurements every second. Of these about 20% do not fulfil the aim of the analysis, corresponding to about €$3000\ billion$.

Environmental quality

The introduction of total quality techniques certification has enlarged their intervention field from products to services and producing systems. With reference to environmental problems the voluntary evaluation has grown, fulfilled by the same firm towards its laboratories with the aim of ensuring and maintaining the efficient management of the environment.

This approach needs a preliminary analysis of all the factors of environmental impact boand to the activity of the firm.

This analysis has to:

? describe the site where the firm is placed in terms of climate, hydrogeology, prevailing destiny of the zone (agriculture, industry, housing), pollution sources and eventual synergisms

? describe the production cycle and quantify the matter and energy fluxes

? identify the factors of potential environmental impact.

On the basis of environmental analysis the firm establishes the actions to be performed and the controls to be adopted in order to reach the objectives of the programme - a friendly approach to the environment. These objectives are, primarily, prevention and a decrease in accidents which may cause environmental damage, a decrease in consumption of energy and resources and the minimisation of effluent (water, wastes, gases).

Environmental measurements

One might assume that the results obtained today are more reliable than those obtained in the past. This can be true. The technology has improved, instruments for the quality control are available and new methods have been set up. Nevertheless it is demonstrated that sometimes the furnished data are unreliable. The evidence of unreliable results comes largely from interlaboratory studies where specialistic laboratories analyse the same samples. The problem is that the level of the quality control applied in the past by the analysts for the measurements is not sufficient to satisfy the contemporary analytical problems. There are many reasons that can bring about the production of wrong results: calculation errors, uncalibrated instruments, inaccurate methods or their inaccurate use (e.g. new pollutants determined concentration out of the useful range, interfering analytes not removed). When some modifications are introduced using a validated method, it is necessary to test its robustness, i.e. the ability not to lose accuracy and not to depend on experimental conditions.

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