18.4.3 Performance characteristics of the measurement process

18.4.3.1 Structure of the CMP

The general structure of the CMP is indicated in Fig. 18.4.1. Here, the symbol x represents the analyte amount (mass or concentration) contained in the test portion taken for analysis. The CMP that operates on x (solid box in the figure) consists of two primary substructures: isolation of the analyte and instrumental measurement (first dashed-line box) that converts x to a signal or response y, and an evaluation unit (second dashed-line box) that transforms y back into an estimate $\hat{x}$ of the analyte amount, together with its uncertainty derived from the detailed structure of the system and/or external calibration (for a non-absolute measurement process) and error estimation.

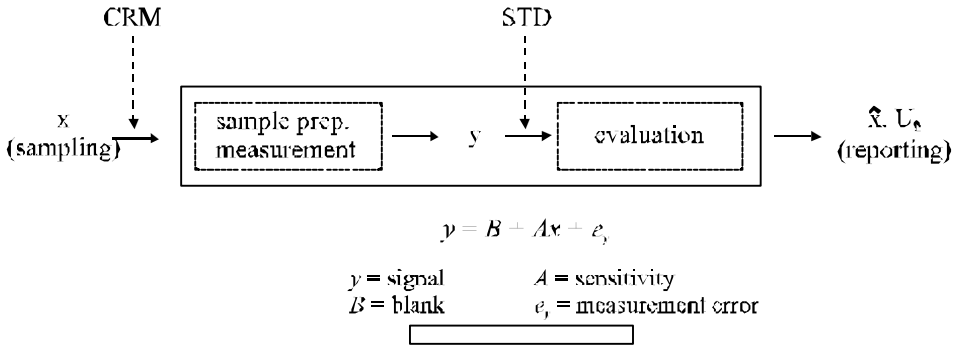

Fig.18.4.1 Schematic diagram of the Chemical Measurement Process.

Two important control measures are shown above the diagram: *CRM*, which relates to control of the accuracy of the overall CMP through the use of *Certified (or "Standard") Reference Materials*; and *STD*, which relates to control of the accuracy of the evaluation (data reduction) step through the use of *Standard Test Data* (see 18.4.3.6). Treatment of the output of the CMP -- ie, Presentation of Results -- is the subject of Chapter 2.

Uncertainties introduced in both of the principal steps of the CMP become the basis for the statistical performance characteristics. Further detailed specifications for the structure may be necessary to bring these uncertainties within acceptable bounds, and to guarantee an adequate degree of ruggedness. *Ruggedness* means that the precision and accuracy of the method are insensitive to minor changes in environmental and procedural variables, laboratories, personnel, etc. Otherwise, imputed performance characteristics would depend upon a number of uncontrolled factors, and would have limited utility.

The internal structure of the measurement process may include such steps as dissolution, chemical separation and purification, application of a particular instrumental measurement technique, plus the detailed scheme or algorithm for data reduction. Internal replication, calibration, and blank estimation also would constitute elements of the CMP structure. In certain applications it may be appropriate to augment the structure to include sampling, and in others, to diminish it to focus on instrumental measurement. In any case, all of the structural elements of the specific measurement process ought to be indicated in a complete flow diagram.

Note: The abbreviations *CRM* and *SRM* which appear in Section 18.4.3 and Fig. 18.4.1 both denote a reference material that is certified. The former refers to the generic term, *Certified Reference Material*. The latter is used exclusively by the U.S. National Institute of Standards and Technology for its certified reference materials, each of which bears the label *Standard Reference Material (SRM)*.