Short Course in Data Reconciliation and Instrumentation Upgrade

Instrument readings are inaccurate and do not conform to basic conservation laws. In many facilities, plant operators still assume that their readings are accurate enough for their monitoring and control purposes. As imbalances create conflicts with production accounting clerks, balances are forced by several ad-hoc techniques, such as eliminating some measurements or correcting those that in the experience of the operator are less trustworthy. In the decade of the eighties data reconciliation techniques were introduced in industry, the oil industry being again the pioneer. Not only these techniques are able to enhance the accuracy of plant data, but also they are capable of helping identify and somehow filter instrument gross error and bias. With the introduction of new techniques in data processing, the chemical and petrochemical industry is undergoing a fundamental transformation of its plant management procedures. Several software packages offered in the market allow improved Performance Reporting through Data Reconciliation. These packages include Data Reconciliation and Instrument Fault Detection. As a result, much improved Process Economical Performance Analysis can be performed. At this stage, these filtered data can be used for control purposes and/or on-line optimization in the short time scale, as well as Operation Planning in the longer time scale. Finally, Production Accounting is improved. This course is aimed at the understanding of the principles of this field as well as the methodologies used in current commercial software for data reconciliation. In addition recently developed techniques that address the detection of biased instruments, the estimation of leaks and sensor network retrofit will be covered.

The instructor is a Professor at the Chemical Engineering Department and Director of the Center for Engineering Optimization of the University of Oklahoma. He holds a Ph.D. from the California Institute of Technology and has been a Professor in Argentina and has performed research and teaching at UCLA. His industrial experience includes a six-year project to build a heavy water plant in Argentina, several consulting work and a three years position at Simulation Sciences (SIMSCI), where he participated in conceptual development, software programming and on-site training and sales projects. He has several publications in the area of design and data reconciliation.

Course Content. (Can be made a 3 days course by expanding the instrumentation upgrade part)

Day 1.

- Introduction. Objectives of Data Reconciliation
- Review of Statistics and Matrix Operations
- Measurement Methods and Errors.
- State Variable Classification. Redundancy. Observability
- Material Balance Reconciliation. Introduction.
- Material Balance Reconciliation. Canonical Forms. Standard Deviation of Estimates

Day 2.

- Instrument Bias and Leak Detection. Global, Measurement and Nodal Tests.
- Serial Elimination. Gross Error Detectability. Equivalencies of gross errors.
- Collective Compensation of Gross Errors.
- Component and Energy Reconciliation.
- Sensor Network Robustness Measures. Introduction to Sensor Network Retrofit
- Elements of Dynamic Data Reconciliation

Day 3 (optional)

- Accuracy and the value of new instrumentation. Procedures for upgrading

Hands on exercises using a Data Reconciliation package: PRECISE (Ok-Solutions, OK), will be included.