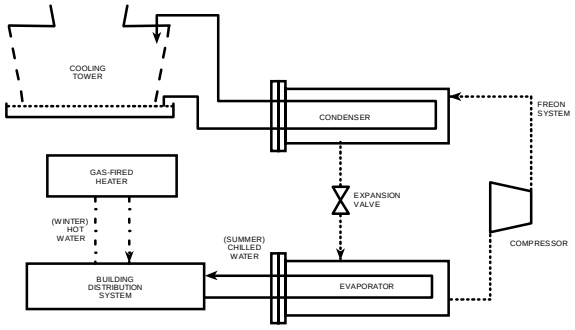
Who are we? Why are we here?

Marvin Silbert and Associates

In spite of the potential risk, water chemistry tends to get a low priority in many industrial plants. MS&A began with the goal of providing plant operators objective audits of system performance to minimize costs and optimize the various processes or to perform those special projects that are needed, but not performed due to restrictions in staff availability. We give industrial plants the opportunity to *time share* their own Chemist / Chemical Engineer.

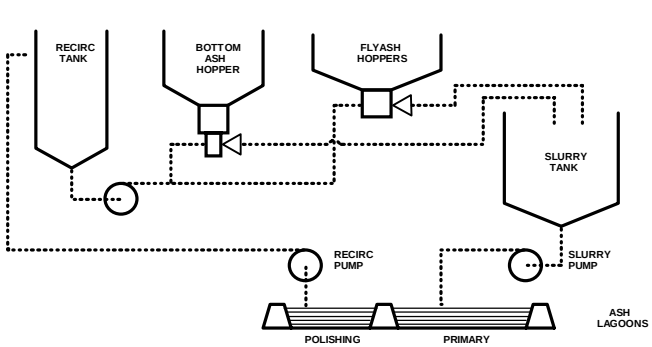
Over the years we have performed a wide range of industrial water-treatment projects ranging from building HVAC systems to nuclear steam-supply systems. We look at water systems from the point the water enters the plant until it is discharged. This ability to see the overview comes from a background of direct *hands-on* experience and gives us a distinct advantage as we can look for ways to reduce effluents and conserve energy by improving control on the influent and process water systems. We also assess the various environmental and safety aspects and can prepare audits.

Marvin Silbert and Associates are prepared to undertake any projects you might have related to water systems, environmental releases, safety and environmental audits. We cover the entire spectrum from small HVAC systems to the biggest industrial systems in the country. We have experience in the following areas. Under NAFTA, we are now able to work on both sides of the Canada-USA border.



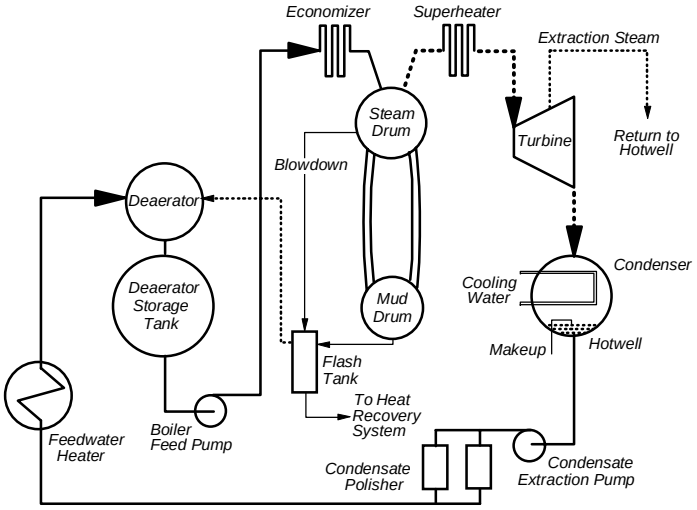
Troubleshooting industrial plants/commercial properties

- technical assistance during the commissioning of water systems for continuous casting machine.
- assessment of boiler feedwater problems for plant utilities departments at several major iron & steel, pulp & paper and petrochemical plants.
- trouble shooting of HVAC and domestic hot water systems in various apartment buildings, commercial properties, government buildings and universities.
- optimize chemical control of water systems in nuclear, fossil-fired and cogeneration boiler plants.



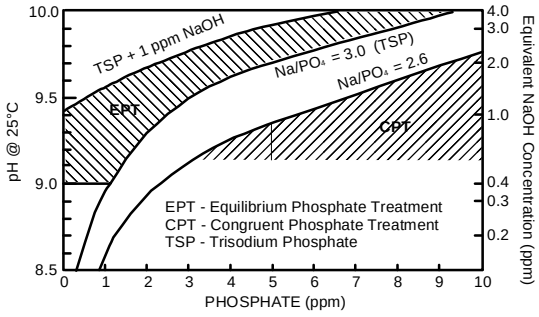
Optimization of chemical treatment equipment and programs including the development of standardized supplier contracts

- recommendations for water-treatment plants for energy-from-waste and combined-cycle cogeneration boilers
- preparation of standardized contracts for HVAC within major real-estate operations
- assistance to the design, construction and commissioning of effluent treatment plants.
- introduction of statistical process control (SPC) to industrial water-treatment plants



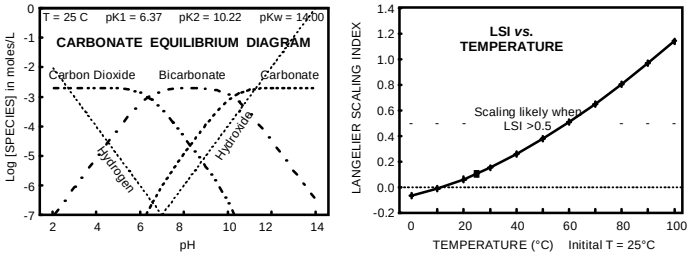
Environmental, safety and legal

- Expert witness for cases that go to court
- Assess validity of claims made for Revenue Canada *Scientific Research and Experimental Development* program
- preparation of effluent monitoring database for Canadian electrical power plants (with Zenon Environmental and Concord Scientific) for Canadian Electrical Ass'n
- assess effluent monitoring and sampling requirements for Ontario Hydro to comply with MISA environmental legislation (with MacLaren Engineers) for Min of Environment
- prepared manual, *Energy Conservation through Improved Water Treatment*, for joint publication by Ontario Ministries of Health and Energy
- fire & safety audits for commercial properties
- environmental audits of industrial & commercial sites



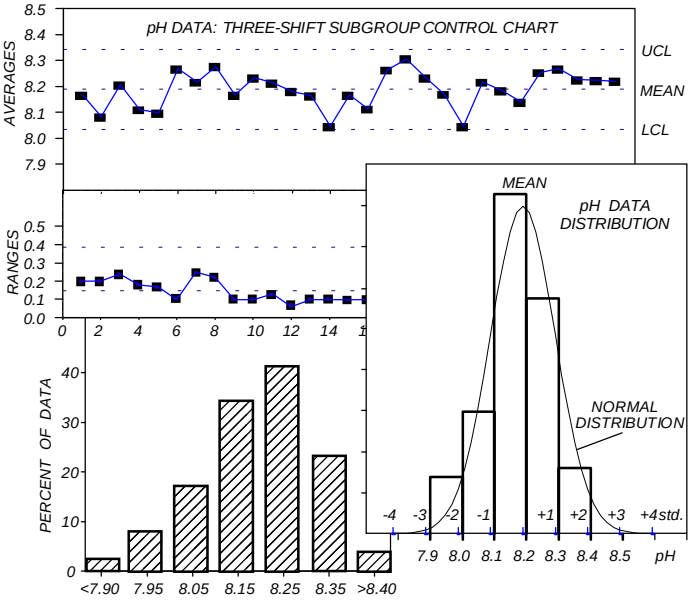
Specialized studies and R&D Projects

- scale control in recirculating ash-transport systems (with Zenon Environmental); presented as Paper 86-47, Int'l Water Conf. and updated for CEA/Env. Canada Workshop, Montréal
- evaluated future water treatment options for nuclear steam supply systems in NB Power's Point Lepreau (Paper 88-34, Int'l Water Conference) and Ontario Hydro's nuclear plants
- assessment of methods for analyzing natural organics in water systems for Hydro-Québec
- assessment of environmentally benign methods for condenser cleaning for Canadian Electrical Association



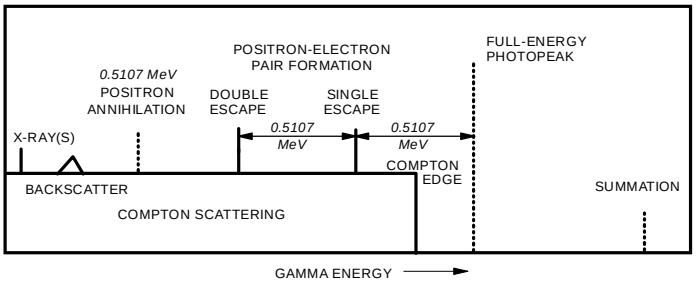
Computer applications

- prepare a monthly computer hardware and software review columns in ***Canadian Chemical News*** and ***Ultrapure Water***
- development of programs using a variety of statistical methods for handling process data
- prepare manuals with accompanying on-line Help files
- development of software to calculate scaling potential of water systems and cooling tower water/chemical usage.



Training courses, seminars and workshops

- *Industrial Water Treatment:* Southex Process Equipment and Instrumentation Show, Toronto
- *Computers and the Small Engineering Business, Techniques for Handling Process Data:* Chemical Institute of Canada, Continuing Education Courses, Queen's U, Kingston
- *Handling Process Data:* 3rd North American Chemical Congress, Toronto, Technical University of Nova Scotia, Halifax, Ultrapure Water Expo, Philadelphia
- *Plant Systems:* Prepare in-plant training for cooling water, boiler chemistry, equilibrium phosphate treatment, radiochemistry, plant systems, *etc.*
- *Plant and Supplier Training:* Provide user courses and manuals for equipment suppliers and plant operators



Some recent publications

H.K.Miyamoto and M.D.Silbert, ***A new approach to the Langelier Stability Index***, Chem Engineering 93 #8, 89 (1986).

M.D.Silbert, G.M.Nicolaides and F.A.Tonelli, ***Identification and control of scaling in recirculating ash disposal systems***, paper 86-47, 47th Int'l Water Conference, Pittsburgh (1986); also presented CEA Fall 86 meeting, Edmonton.

M.D.Silbert, ***Energy conservation through improved water treatment***, issued by Ontario Ministries of Health and Energy, ISBN 0-7729-2857-6, Queen's Printer for Ontario (1987)

C.K.MacNeil and M.D.Silbert, ***A new look at phosphate vs AVT for nuclear steam generators***, paper 88-34, 49th Int'l Water Conference, Pittsburgh (1988)

M.D.Silbert, ***Non-chemical water treatment - I***, CHES (Canadian Hospital Engineering Society) Journal, 10 #1, 11 (1990)

M.D.Silbert and H.K.Miyamoto, ***Monitoring and Controlling Industrial Processes***, ISBN 0-9695133-0-5, Marvin Silbert and Associates, Toronto (1990)

M.D.Silbert and C.K.MacNeil, ***Point Lepreau 600 MW CANDU experience***, American Society of Mechanical Engineers (ASME) Research and Technology Committee on Water in Thermal Power Systems Workshop on Lab. and Field Experiences with Phosphates in Power Utility Drum Boilers, Pittsburgh, Oct 1990

M.D.Silbert and H.K.Miyamoto, ***Simple time-series techniques to analyze plant operations***, 3rd Int'l Conf. on Statistical Methods for the Environmental Sciences, Madison, WI (1991)

M.D.Silbert, L.Lépine and R.Gilbert, ***Organic matters in recirculating water systems of CANDU-PHW reactors, Step 1: Literature search***, Institut de recherche d'Hydro-Québec report IREQ-91-126 (1991)

M.D.Silbert and H.K.Miyamoto, ***Reassessment of the role of specifications in plant control philosophy***, Industrial Water Treatment, 10 #5, 30 (1993)

H.K.Miyamoto, M.D.Silbert and J.H.Washburn, ***Statistical training for quality improvement***, Canadian Chemical News / L'Actualité chimique canadienne, pp 19-21, July/Aug (1993)

M.D.Silbert, ***Environmentally benign condenser cleaning agent***, Report # 9115G 898 for the Canadian Electrical Ass'n (1993)

J. Stodola and M.D.Silbert, ***Enhanced Phosphate Control in Drum-Recirculating Boilers***, Industrial Water treatment, 28 #1, pp 41-46, January/February (1996)

For more details contact:

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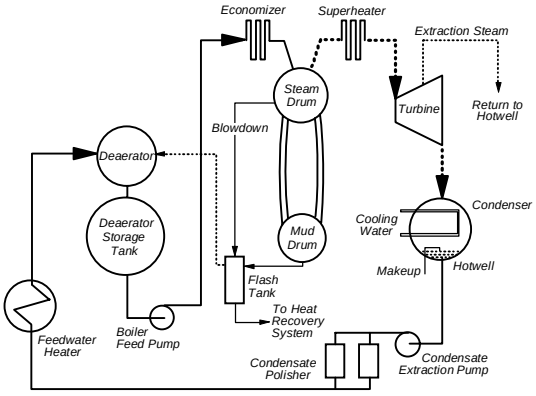
Internet: marvin@silbert.org, http://www.silbert.org/

Industrial Training Courses and Software

Water Treatment for Industrial Plant Utilities

Boiler and cooling systems are made from metals that try to revert to their natural state, *i.e.*, they corrode. Add a variety of chemical species trying to deposit on heat-transfer surfaces and microbiological species finding the ideal conditions for growth. The result is a complex system that must be carefully controlled to prevent any loss of heat transfer or permanent damage. To cope with this, water treatment has evolved over the years into a rather comprehensive subject. These courses are designed to give a general overview starting with the raw water and working through the process. They also look at effluent control. As management is often better able to understand O&M dollars rather than concentrations for individual chemical species, a number of methods that relate analyses to *practical* parameters will be included. The water-treatment industry has developed an extensive arsenal of treatment products and programs. How will they perform within your system? What are the risks or benefits from adding less than or more than the prescribed product dosages? What is the fate of a chemical treatment product within the system? ... and in the environment? Are there alternative treatment products that may be more effective or does it make more sense to put the effort into hardware?



New Trends in Boiler Water Treatment

This course describes water treatment for boiler applications and covers the entire range from low-pressure to high-pressure applications for once-through and recirculating boilers of any size or shape, fossil-fuel fired or nuclear. It is an improved version of our earlier course ***Application of Equilibrium Phosphate Treatment to Utility Boilers*** (ISBN 0-9695133-2-1) to include oxygenated treatment and greater depth to the discussion of dispersants and scale modifiers.

Introduction to Boiler Systems - Compares boilers according to design and operating pressure. Shows how concentration occurs and can be controlled.

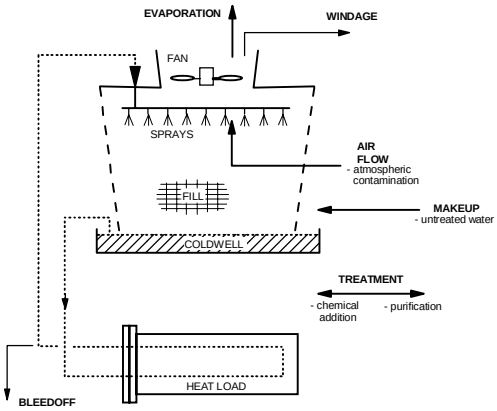
Alkalinity Control - Shows how alkalinity and pH can be monitored and controlled. Includes discussion of temperature effects upon pH. Discusses the chemical volatile amines and solid products used to control pH.

Dissolved Oxygen Control in Closed Systems - Describes the effects of dissolved oxygen in maintaining boiler integrity and how this can be controlled with mechanical deaeration and chemical oxygen scavengers. Also discusses the newer approach using oxygenating chemistry.

Internal Treatment for Deposit Control - Explains the action of scale modifiers and chelants to minimize the formation of hard deposits from hardness brought in with the water or interaction with some of the treatment products.

Phosphate Treatment - Describes the evolution of phosphate treatment through coordinated, congruent and the newer equilibrium phosphate treatment.

Monitoring & Controlling a Boiler Treatment Program - Goes through the basics of doing a mass balance within a boiler system. Looks also at methods to find hideout by monitoring chemical changes that accompany load changes.



Using Water for Industrial Cooling Applications

This course looks at all aspects of using water for cooling in systems ranging from HVAC to heavy industry. It included discussions of methods to monitor the effects of fouling and scaling as well as methods to alleviate the problems.

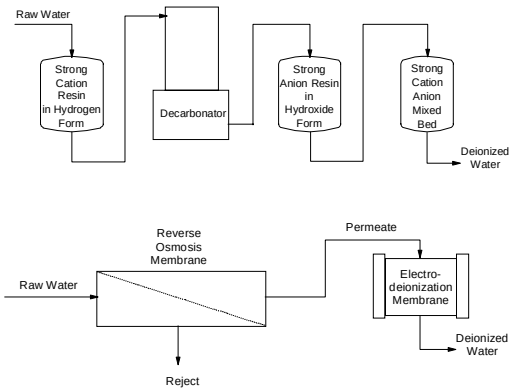
Why do We Need Water Treatment? - Describes the properties of water and problems they present in its industrial use. Includes the basics of corrosion, scaling and microbiological fouling.

Cooling Water Treatment - Compares once-through, open recirculating (cooling tower) and closed recirculating cooling systems. The expected problems that might be encountered in each are described along with the required solutions.

Cooling Systems - A variety of cooling systems are described along with a discussion of the expected problems. The systems described include HVAC, industrial cooling towers and industrial process cooling.

Monitoring Cooling-System Performance - Methods for detecting the loss of efficiency scaling or microbiological fouling in steam condensers for large generating stations and HVAC chillers.

In-Service Cleaning procedures - Techniques for both off-line and on-line cleaning to restore the efficiency of condensers and heat-exchangers back to their original efficiency.



Preparing High-Quality Water for Industrial Applications

This course provides an overview of the option available to make high-quality water for a variety of industrial applications. A short course ***Bringing New Life to Aging Water-Treatment Plants*** (ISBN 0-9695133-4-8) is also available. This shorter version is based upon second half of the complete course. The Table of Contents for the complete package includes:

Why do We Need Water Treatment? - Describes the properties of water and how they impact upon its industrial use. Includes the basics of corrosion, scaling and microbiological fouling.

Disinfection - Describes chlorination and the alternatives including ozone, chloramination, bromination and chlorine dioxide.

Clarification - Shows how the coagulation-flocculation process converts the unfilterable colloids into filterable solids. Describes the advantages of different coagulants and clarifier designs.

Filtration - Starts with a discussion of the various conventional methods for mechanically separating solids and then moves into a discussion of membranes techniques including micro and ultrafiltration and reverse osmosis.

Ion Exchange - Describes the operation of ion-exchange systems in service and during regeneration. Includes a discussion of resin types and electrodeionization.

Meeting the Needs of the System - Describes how to match the equipment to the needs of the system. Includes a discussion of closed loop demineralized water systems for critical cooling applications.

Optimizing the Operation - Describes methods to make a water-treatment plant or a water system behave better. How should it be monitored? What about special techniques such as HazOp? Troubleshooting and priority setting.

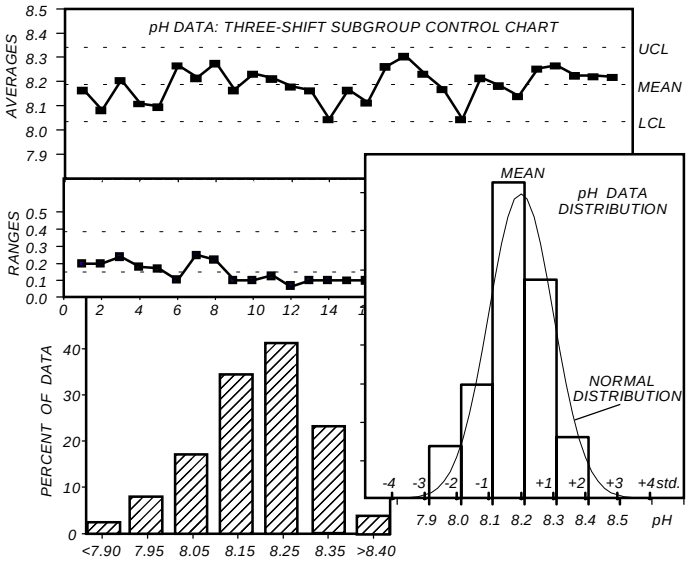
Upgrading the Operation - Water-treatment plants can't go on producing forever. What do you do as it ages and you need water? Should you make or buy? Can we build a better plant?

Course Objectives

A knowledge of water treatment principles is vital to those who operate and design industrial boiler-plants. That need is the same whether it be a major electrical generating station, a small cogeneration plant or a steel mill. The larger plant may have full-time chemical staff. With the smaller plants, it is the operator on shift who must cope with upsets in water chemistry. These courses are designed to provide that basic water-treatment knowledge, needed to effectively troubleshoot and optimize the operation of water systems in their plants. That knowledge can also give designers an insight into some practical aspects of operating the plants and the most suitable water-treatment equipment.

Monitoring and Controlling Industrial Processes

As most operating data is used to assess whether or not a plant is operating within specifications, it rarely gets more than one quick look before it is filed and forgotten. Whether we admit it or not, this is a *police action* to provide the proof that analyses were performed and recorded. It does not ensure that their real meaning was determined nor that the consequences of operating outside specification was considered. **What is a specification?** If a few plants appear to operate successfully within a certain regime, that regime tends to become the norm and gets carved into stone as a specification. **Will that spec be correct for all plants?** Not likely. Often the plant tries to tell us something, but we need the tools to listen. If we didn't force them to do so, many plants could never operate within some of their specs. What are the consequences of making them operate this way?



Statistical Process Control or **SPC** provides us with a better way to monitor and control plant operations. It is impossible to check or inspect 100% of anything. Rather than take more and more samples, SPC uses some simple statistical techniques to get a better handle on a process and improve both productivity and quality. Coupled with Time-Series Analysis, it provides a powerful arsenal of diagnostic and control tools. SPC techniques are now mandatory for automotive industry suppliers.

This course is relevant to all field personnel who collect or use data. The goal is to demonstrate simple methods to extract relevant information hidden within data, not to make anyone into a statistician not to make them computer dependent. Most of the techniques can be accomplished with paper and pencil. This course shows how to make plant data talk and tell more about the plant's operation. It also includes lots of ideas for trouble-shooting, priority setting freeing up time for those taking and reporting the data.

Why do we need to look deeper? A generalized look at the need for good monitoring and control, difficulties with sampling a real system, course objectives.

Data formats: Starting with a table of numbers and proceeding through a number of simple graphical techniques that can make the trends within the data more visible. Scatter plots, runs charts, fitting mathematical formulae to data, histograms and the application of 3D and multi-variable plots. How do conventional graphing techniques lead to poor control.

Data distributions: Applications of the Normal, Poisson and Binomial distributions, methods for reporting and how they are used to compare data using graphical techniques, confidence intervals and analysis of variance.

Medians & percentiles: Application of frequency distributions for QA applications, comparisons using box-and-whisker plots.

Time-series analysis: Simple test procedures to check for randomness, trends and periodicity.

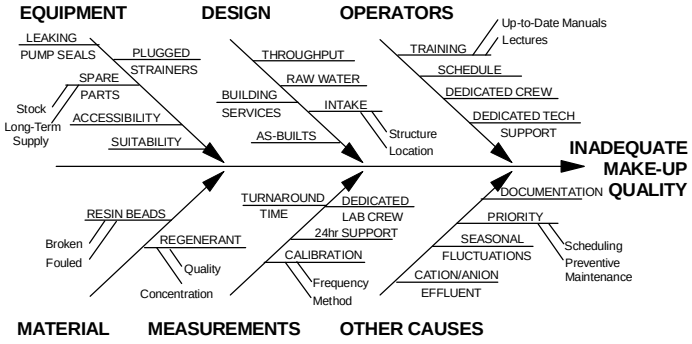
Statistical process control: Statistical control, Type I and II errors, process capability, capability ratios for objective comparison against specifications, $\bar{x}$ & R, median and CuSum control charts, subgroups and moving averages, attributes, c, u, p and np control charts, what to do with bad data.

The electronic log sheet: Utilizing spreadsheet programs to custom design reporting systems, off-the-shelf field equipment.

Applications in the field: Cost, reliability, availability, sensitivity, servicing and calibration of instruments *vs.* manual sampling, monitoring controlled systems, steady state *vs.* batch, continuously varying processes, relationships among parameters.

Applying quality methods: Establishing a QA program, cause-and-effect analysis using Ishikawa diagrams, priority setting with Pareto charts

Plus: A bibliography showing where more information can be found and a blank SPC Control Chart form for making your own control charts.



Course Objectives

Attendees are expected to gain a much better understanding of the processes they monitor by learning how to work with the statistical nature of their data and to integrate some simple, but effective statistical techniques into their everyday operation. In doing so, they will learn how to get better control and to detect potential upsets that could result in lost production or deratings. They will also learn how to set quantifiable objectives that can increase productivity and reliability.

Customized Training and Documentation Packages

The course material is available in a modular format and a number of individual modules have now been combined into formal programs. We can make professional quality customized training courses, manuals and any other documentation that you need to meet your needs which can include:

- staff training manuals and classroom sessions including operating procedures and plant systems.
- training for designers as part of their turnkey startup package.
- proprietary training for equipment suppliers to cover theory and procedures during installation and startup.
- manuals and stand-alone documentation
- computerized manuals and training packages.
- specialized topics such as radiochemistry and γ spectrometry.

Who Should Attend Our Courses?

- Water-treatment plant operators
- Plant chemist/chemical engineer
- Water-treatment vendors
- Plant and equipment designers
- Environmental engineers
- Boiler-plant operators
- Chemical technicians
- R&D staff
- Plant operators

Who Has Attended Our Courses?

Ontario Hydro, Dofasco, Nalco, IBM, Culligan, General Electric, AT&T Bell Laboratories, Intel, Seagate Technologies, Kidd Creek Mines, Eimco, BF Goodrich, Westinghouse, Arrowhead Industrial Water, AECL, Litton Systems, Texas Instruments and many more from Canada, USA, UK, Ireland, Germany Brazil and Singapore.

Format

- In-house programs available to match shift schedules
- Workshops for professional and non-professional staff
- Course notes provide a valuable reference.
- Notes can be customized for in-house use.
- Group and in-house rates available

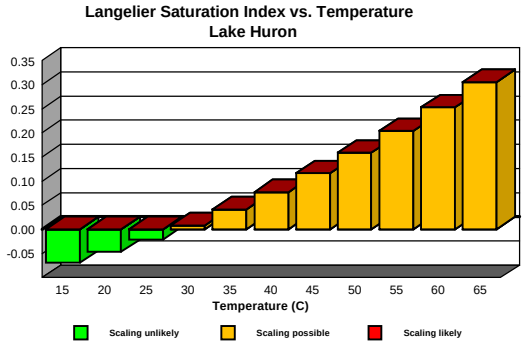
Manuals

All attendees receive a complete manual. Course manuals may also be purchased separately for those who are unable to attend. The manuals listed below are available for US$ 100 each plus S&H. Quantity discounts are available.

Title	ISBN
Monitoring and Controlling Industrial Systems, 2nd Ed	0-9695133-1-3
Preparing High-quality Water for Industrial Applications	0-9695133-5-6
Bringing New Life to Aging Water-treatment Plants	0-9695133-4-8
Using Water for Industrial Cooling Applications	0-9695133-6-4
New Trends in Boiler Water Treatment	0-9695133-3-X
Application of Equilibrium Phosphate Treatment to Utility Boilers	0-9695133-2-1

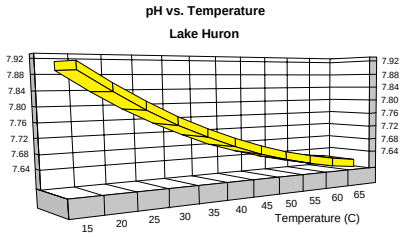
Water-Treatment Software

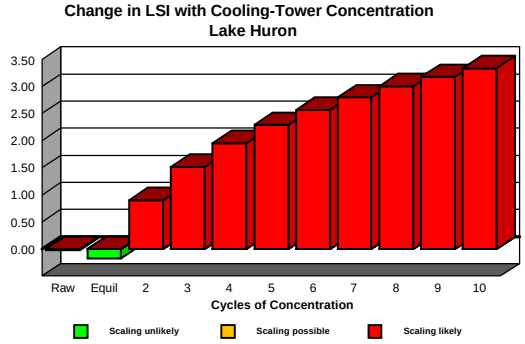
We presently offer two water-treatment packages. Both are compatible with Windows 3.1/9x/NT and use a simple menu structure to input data or modify selection criteria. Graphs can be printed or imported into your word processors or graphics programs.

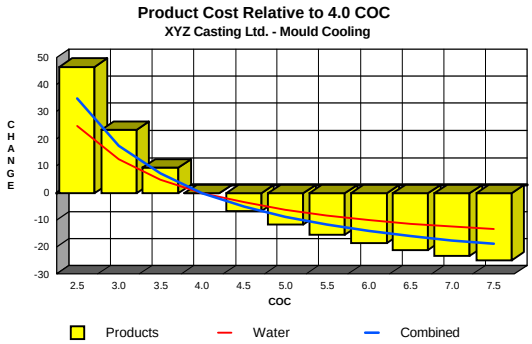


W–index

W-index goes back to the original carbonate equilibrium equations to calculate the various scaling indices. Unlike the more common calculations based upon approximations, W–index can easily handle those high-pH situations where erroneous results are common. Take a 12°C water with 2,000 ppm TDS, 585 ppm Ca, 495 ppm total alkalinity (all ppm as $CaCO_3$) and a pH of 12.6. Run it through your present program or calculation. If you present method gives a Langelier Index of 5.7, you are with the majority and find this to be a very scaling water. If your value was -0.1, you have justified your need for W-index. This is not a scaling water and an LSI of -0.1 would be much more appropriate. In addition to the Langelier Index, W-index calculates the Ryznar and Puckorius indices plus the Skillman index for calcium sulfate scaling and the Larson-Skold index for estimating the likelihood of pitting in carbon steel. W-index has a powerful *what if?* engine. In just a few seconds, you can see what happens if you can change the temperature of the water, cycle it in a cooling tower or adjust the recovery rate in an RO system. If that's not enough, look at the spectacular graphics.

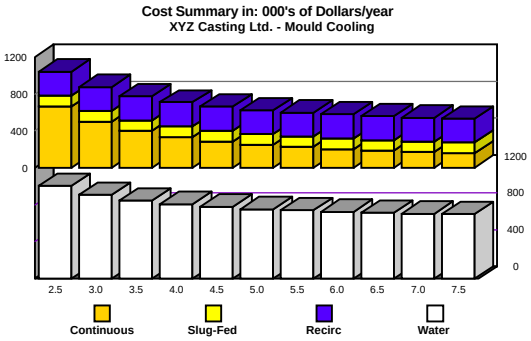






C–tower

C–tower performs all the *standard* cooling-tower chemical and water usage calculations and it does so over a wide COC range. Each calculation provides several tables and more than a dozen graphs. C–tower immediately reacts to the questions: What if I change a product's cost? ...its dosage? ...or the system's flowrate? You can insert your own costs for treatment products and water. Set a maximum allowable alkalinity and the required dosage of sulfuric acid will be calculated. The powerful *what if?* engine simplifies the fine tuning a proposal. It's also great for training new employees. Select a single COC value and compare water and product usage with higher and lower values to see where you can get the maximum return from sharpening your pencil. Mix or match metric, Imperial or US unit systems to accommodate those older plants that started in one system and now operate in another.



Contact us for more details about our training programs or software.

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More details and software DEMOs are available on our website.

World-Wide Web: http://www.silbert.org